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# Social anxiety in adolescence

The role of cognitive biases and social status



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Behavioural  
Science  
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# **SOCIAL ANXIETY IN ADOLESCENCE**

**The role of cognitive biases and  
social status**

**Lisan Henricks**

## **COLOPHON**

ISBN: 978-94-6458-551-3  
Design: Danielle van Oosten  
Lay-out: Publiss | [www.publiss.nl](http://www.publiss.nl)  
Print: Ridderprint | [www.ridderprint.nl](http://www.ridderprint.nl)

This research was supported by the Behavioural Science Institute (BSI), Radboud University Nijmegen.

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# **Social anxiety in adolescence: The role of cognitive biases and social status**

Proefschrift

ter verkrijging van de graad van doctor  
aan de Radboud Universiteit Nijmegen  
op gezag van de rector magnificus prof. dr. J.H.J.M. van Krieken,  
volgens besluit van het college voor promoties  
in het openbaar te verdedigen op

dinsdag 20 december 2022

om 10.30 uur precies

door

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te Utrecht, Nederland

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The role of cognitive biases and social status**

Dissertation

to obtain the degree of doctor  
from Radboud University Nijmegen  
on the authority of the Rector Magnificus prof. dr. J.H.J.M. van Krieken,  
according to the decision of the Doctorate Board  
to be defended in public on

Tuesday, December 20, 2022

at 10.30 am

by

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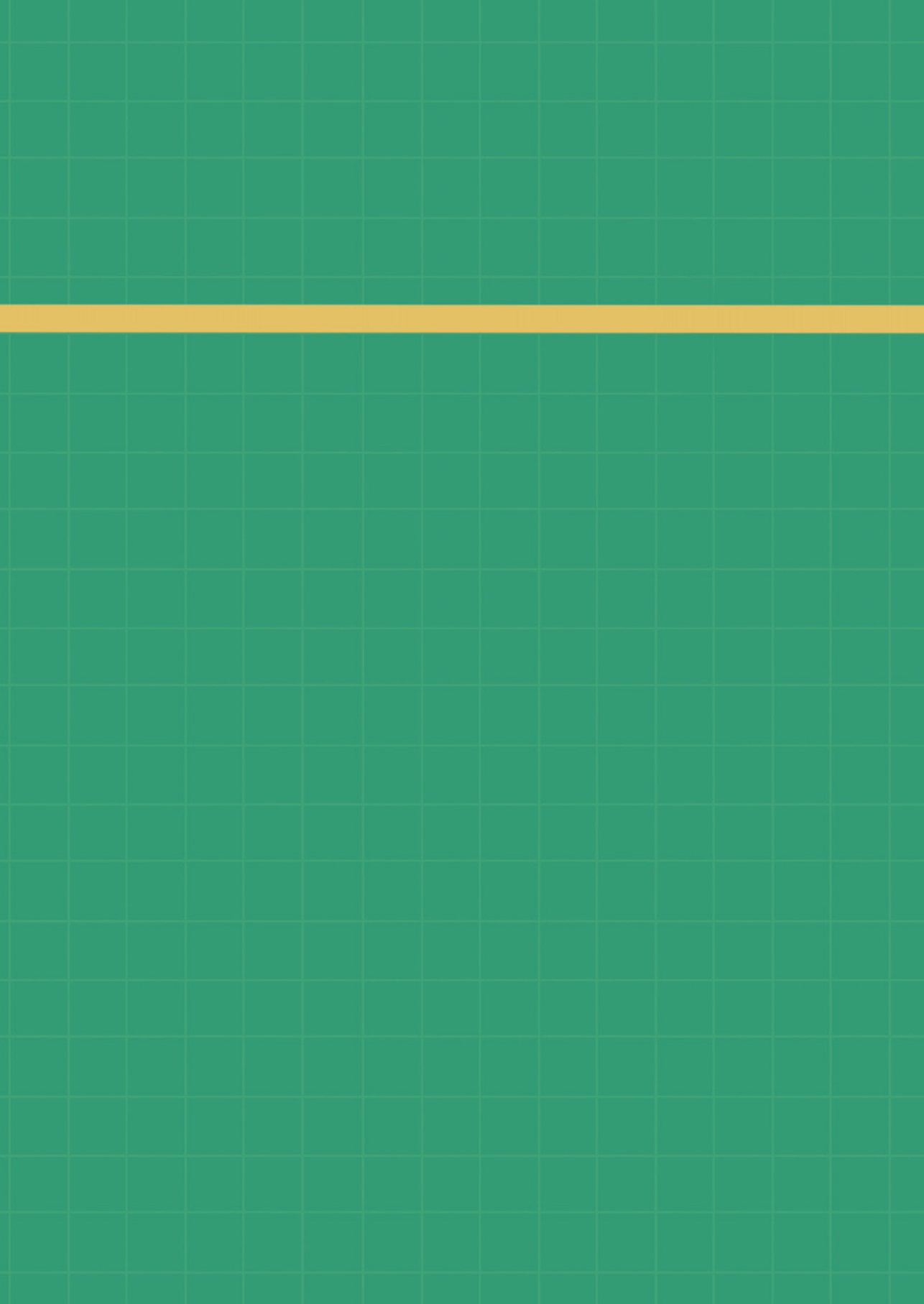
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# CONTENTS

|                  |  |            |
|------------------|--|------------|
| <b>Chapter 1</b> | General introduction   | 9          |
| <b>Chapter 2</b> | The longitudinal interplay between attention bias and interpretation bias in social anxiety in adolescents                 | 31         |
| <b>Chapter 3</b> | A new social picture task to assess interpretation bias related to social fears in adolescents                             | 65         |
| <b>Chapter 4</b> | Prospective associations between social status and social anxiety in early adolescence                                     | 97         |
| <b>Chapter 5</b> | The longitudinal link between popularity, likeability, fear of negative evaluation and social avoidance across adolescence | 119        |
| <b>Chapter 6</b> | General discussion   | 147        |
|                  | <b>English summary</b>   | <b>177</b> |
|                  | <b>Dutch summary (<i>Nederlandse samenvatting</i>)</b>   | <b>185</b> |
|                  | <b>References</b>  | <b>195</b> |
|                  | <b>Data management and transparency</b>  | <b>221</b> |
|                  | <b>About the author</b>  | <b>225</b> |
|                  | <b>Acknowledgements (<i>Dankwoord</i>)</b>   | <b>229</b> |



# Chapter 1

## General introduction

## **SOCIAL ANXIETY IN ADOLESCENCE**

Imagine going to your friend's birthday party and you do not know anyone else among the guests. Or imagine the first day at school or work when you have to meet all of your new classmates or colleagues. In such situations you might, for instance, worry about whether you will have someone to talk to, what others might think of you, and you are afraid that they will judge you negatively. These social fears are quite common but generally prove to be not justified. Research showed that 51% of adolescents experience some level of social fear in daily life (Wicks-Nelson & Israel, 2009). From a biological perspective, these feelings are also normal and adaptive in social situations as they increase the hypervigilance for potentially threatful stimuli and allow individuals to adequately cope with such threatening situations (Barlow, 2000). For instance, if you are bullied by some classmates (i.e., a socially threatening situation), you may immediately see the bullies standing next to your bike when you step out of the school into the schoolyard (i.e., hypervigilance). Consequently, this might trigger you to first walk to your friends and ask them if they could walk with you to your bike to prevent severe harassment from the bullies (i.e., successful coping with the situation).

For some individuals, these social fears exacerbate into clinical levels referred to as social anxiety disorder (SAD). There is no functional difference between clinical and normal levels of social anxiety, as social anxiety can be understood as a severity continuum rather than as a dichotomous construct (Rapee & Heimberg, 1997; Ruscio, 2010). The main difference with non-clinical social anxiety is that SAD is accompanied by severe interference in the daily functioning of individuals (e.g., impairments in school, work, or social life; Ruscio, 2010). Individuals with SAD react with disproportionate anxiety to non-threatening social situations (American Psychiatric Association, 2013). In other words, social fears are often exaggerated and not justified.

SAD is characterized by the debilitating and persistent fear of social and performance situations in which individuals are afraid to be judged negatively, embarrassed, or humiliated (American Psychiatric Association, 2013). Besides the excessive cognitive symptoms (e.g., the fear to be negatively evaluated by others), SAD is also characterized by physical (e.g., blushing, trembling, sweating) and behavioural symptoms (e.g., both the direct avoidance of and withdrawal from social situations but also more subtle behaviours such as avoiding eye-

contact; Heimberg et al., 2010). Social anxiety disorder is one of the most common psychological disorders among youth (Kessler et al., 2012), with prevalence rates ranging between 5-16% (Burstein et al., 2011; Kessler et al., 2012; Mesa et al., 2011). The onset of social anxiety starts in late childhood and continues throughout adolescence (Beesdo et al., 2011), with a mean age of onset at 15 years (Mancini et al., 2005).

In addition to tremendous individual suffering, SAD is also causing extensive health care costs (Dams et al., 2017; Eng et al., 2005). The risk of comorbid problems such as depression, other anxiety disorders, and substance use is large (American Psychiatric Association, 2013; Beesdo et al., 2007), and seems to be a rule rather than an exception. Eighty percent of individuals with SAD are also diagnosed with another psychological disorder (Merikangas & Angst, 1995). Besides, SAD increases the risk for suicidal ideation and attempts (Cogle et al., 2009). Strikingly, even in its milder and more common form, social anxiety has negative consequences (Weeks et al., 2009). Individuals with heightened social anxiety are known to experience functional impairments at school (e.g., lower grades, failing a year, or school drop-out) or work, and to have more often difficulties with relationships with friends, family, colleagues, or romantic partners (Aderka et al., 2012; Mazzone et al., 2007; Porter & Chambless, 2014; Stein & Kean, 2000; Vilaplana-Pérez et al., 2021). Also, youth with social anxiety have an increased risk of peer victimization (Erath et al., 2007).

When left untreated, SAD often follows a chronic pattern, with lifelong experience of symptoms (Keller, 2006). It would thus be optimal to prevent feelings of social anxiety from exacerbating to a clinical level and to effectively treat individuals with SAD. Unfortunately, the availability of selective prevention programs is limited (except for Aune & Stiles, 2009) and the current treatments, especially for youth, are questionable as they fail to effectively diminish SAD symptoms and a large proportion of individuals continue to fulfil the diagnostic criteria after treatment (Cartwright-Hatton et al., 2004; Hudson et al., 2015). Possibly, these limited clinical effects are due to the fact that SAD is still one of the least researched and treated mental disorders and its theoretical foundations are not well understood (Kashdan & Herbert, 2001). SAD is also marked by heterogeneity, which may also contribute to the moderate effectiveness of treatments. For instance, SAD may present differently in individuals concerning the number and type of feared situations,

the focus of their fears, the areas of functional impairment, and accompanying personality traits (Spokas & Cardaciotto, 2014). At the same time, SAD is an underdiagnosed disorder, probably because adolescents with SAD are oftentimes reluctant to draw attention to themselves, making their symptoms often 'invisible' to their parents and teachers (Kashdan & Herbert, 2001; Kasper, 2006). Given the high prevalence, only moderately effective treatments, underdiagnosis, heterogeneity, and severe consequences of social anxiety, it is obvious that we need a good understanding of the underlying mechanisms of the aetiology and maintenance of social anxiety. Therefore, the studies of this dissertation were designed to unravel several important fundamental issues regarding the development of social anxiety during adolescence, the most critical period for the exacerbation of social anxiety (Beesdo et al., 2011). The project aims at examining factors possibly initiating the development and maintenance of social anxiety and at exploring the working mechanisms, thereby informing possible treatment and prevention programs for social anxiety to prevent (further) severe suffering.

## **THEORETICAL FRAMEWORKS ON THE AETIOLOGY OF SOCIAL ANXIETY**

Many different theories regarding risk factors of social anxiety exist, which can be divided into models describing the maintenance (e.g., Clark & Wells, 1995; Heimberg et al., 2010; Hofmann, 2007; Rapee & Heimberg, 1997), and models specifying the aetiology of social anxiety (e.g., Hofmann & Barlow, 2002; Rapee & Spence, 2004). There are also a few theories integrating the aetiology and maintenance of social anxiety disorder (e.g., Higa-McMillan & Ebesutani, 2011; Kimbrel, 2008; Wong & Rapee, 2016).

In the model of Higa-McMillan & Ebesutani (2011), a distinction is made between predisposing factors such as neurobiological vulnerabilities, inhibited temperament, negative parenting practices and peer relationships, and between precipitating factors which include negative life events or conditioning experiences. Predisposing factors in this model are described as the general risk factors, which set the stage for the development of SAD. Precipitating factors are causal risk factors, which immediately precede social anxiety symptom onset. There are different pathways leading to the onset of SAD: individuals may only encounter precipitating factors, without any predisposing factors, or vice versa, or they may be exposed to both.

The model pays attention to the complexity of social anxiety, as it describes that the different predisposing and precipitating risk factors may also act as maintaining factors themselves (e.g., negative peer relationships). The risk factors may also stimulate the development of other maintaining processes such as cognitive biases (i.e., systematic errors in the encoding or interpretation of social cues). At the same time, the model states that future research should further investigate whether the maintaining processes could be predisposing or precipitating factors as well. For instance, the literature suggests that cognitive biases (which are described as maintaining factors in the model), are causal risk factors of social anxiety, and could thus also be precipitating factors (Beck et al., 2005; Muris & Field, 2008; Spence & Rapee, 2016).

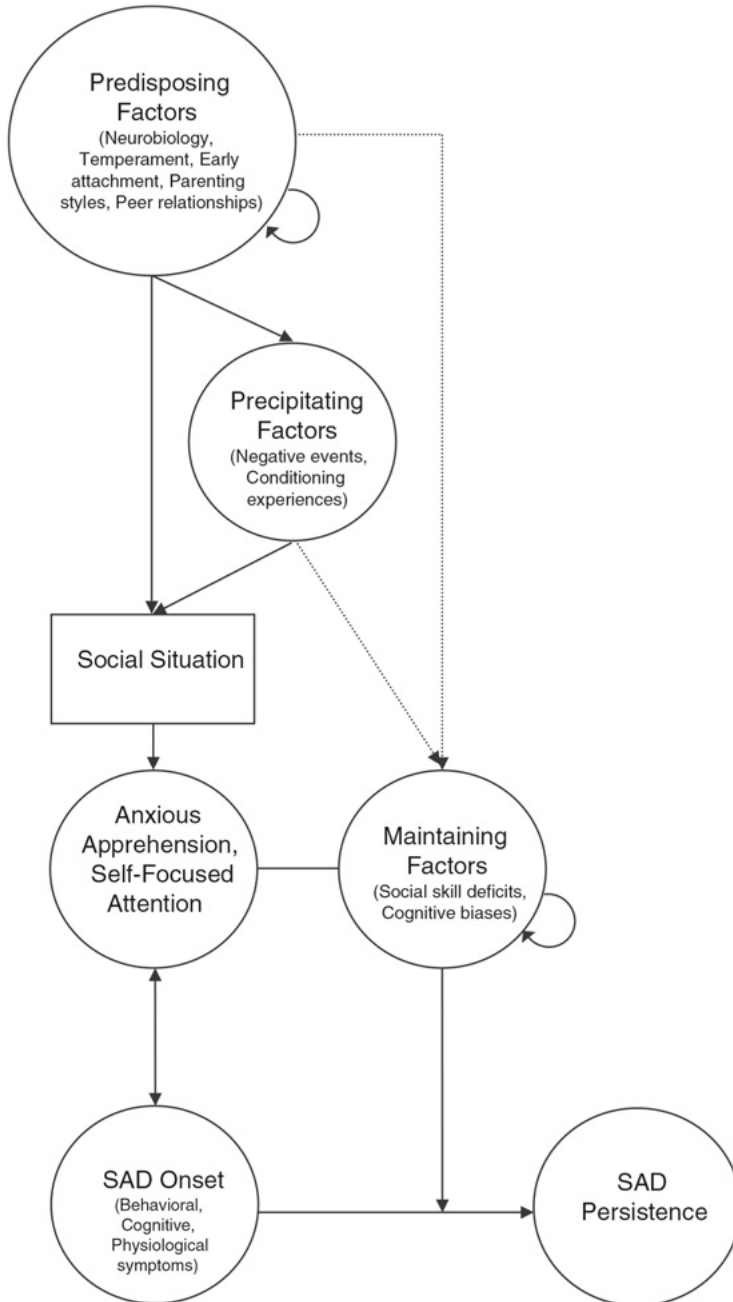
All individuals who develop SAD, experience heightened anxious apprehension and increased self-focused attention when faced with threatening social situations. In other words, due to the alleged socially threatening cue, they primarily focus their attention on themselves, which increases the experience of negative affect. Different maintaining factors (e.g., negative peer relationships and cognitive biases) may be associated with this anxious apprehension and self-focused attention. According to the model, this eventually results in the construction of a negative self-image, leading to the onset of SAD. The maintaining factors may also contribute to the persistence of the symptoms, once SAD has been established.

The model of Higa-McMillan & Ebesutani (2011) defines SAD as a combination of behavioural, cognitive, and physiological symptoms. However, the model does not state whether the different predisposing, precipitating, and maintaining factors are differently related to these symptom types. This is important because there is reason to assume that cognitive and behavioural symptoms should be treated as distinct symptom clusters of social anxiety. Specifically, although individuals may report fear at the cognitive level, this fear does not always transfer to their behaviour in interactions (Cartwright-Hatton et al., 2005). At the same time, cognitive and behavioural symptoms may be differentially related to other constructs, suggesting that they are distinct from each other. For instance, while fear of negative evaluation (i.e., cognitive symptoms) is more related to depression and general anxiety (Inderbitzen-Nolan & Walters, 2000), behavioural symptoms such as social avoidance is more strongly associated with poor friendship quality and competency (la Greca & Lopez, 1998). It is therefore important to understand how the risk and maintaining factors are related to the different symptom types.



**Figure 1**

*The integrated theoretical framework of the aetiology and maintenance of social anxiety disorder by Higa-McMillan & Ebesutani (2011)*



The model of Higa-McMillan & Ebesutani (2011) is directed towards youth in general but does not explain the particular rise of social anxiety symptoms in adolescence. Probably this increase in social anxiety is due to two important developmental changes taking place in early to mid-adolescence: (1) the maturation of socio-cognitive functioning and (2) changes in the (importance of the) peer context (Inderbitzen-Nolan & Walters, 2000; Rapee & Spence, 2004; Westenberg et al., 2004). As a result of these developmental changes, two important risk factors for social anxiety arise: maladaptive cognitive biases (i.e., related to socio-cognitive maturation) and low social status (i.e., a risk factor which becomes important due to peer contextual changes).

Regarding the first developmental change, adolescence is characterized by *socio-cognitive maturation*, which may contribute to an increase in social anxiety (Piaget, 1971). Specifically, due to interactions between brain maturation and language development, adolescents become able to think and reason abstractly (e.g., this stage is called the formal operational stage; Piaget, 1971). At the same time, adolescents develop metacognitive beliefs, which constitute the capacity to reflect on their thoughts and behaviours (Weil et al., 2013). This cognitive maturation may result in heightened self-consciousness and concerns about self-presentation, which is often referred to as the egocentrism of adolescents (Elkind, 1967). Indeed, adolescents are found to develop a mental representation of themselves as seen by others (Rapee & Spence, 2004) and believe that they are the object of everyone's attention (Westenberg et al., 2004). Adolescents become aware of possible discrepancies between self- and peer perceptions of themselves (Inderbitzen-Nolan & Walters, 2000). These cognitive changes involving self-awareness may result in fears about negative evaluation (Westenberg et al., 2004). This socio-cognitive maturation may also result in cognitive biases, which are systematic errors in the encoding or interpretation of social cues. If adolescents are faced with (ambiguous) social situations and tend to interpret the social cues in a threatening way, this may increase their feelings of social anxiety in the current but also in the situation to come.

With regards to the second developmental change (i.e., the peer context), adolescents undergo an educational transition, from primary school to secondary school. They enter a new context with unfamiliar classmates. Making a positive impression on others, obtaining approval from peers, forming new friendships, and establishing

a good position in the social status hierarchy are key processes in this new context (LaFontana & Cillessen, 2010; Pellegrini & Long, 2002). At the same time, adolescents spend an increasing amount of time with peers (Brown & Larson, 2009) and these peers have a heightened influence on a broad range of domains of adolescents' life, such as physical appearance (e.g., clothing style; Beaudoin & Lachance, 2006), lifestyle (e.g., food choice and music preferences; Selfhout et al., 2009; Wouters et al., 2010), academic performance (Wang et al., 2018), and risk-taking behaviour (e.g., substance use and violence; Prinstein et al., 2001). Similarly, peer relationships provide an essential environment in which adolescents can achieve autonomy and form their own identities (Spear & Kulbok, 2004). During adolescence, the peer context is also the setting in which dating and romantic involvement come into play (Zimmer-Gembeck, 2002). Friendships, in particular, are an important source for experiencing intimacy, trust, and emotional support during adolescence (Roach, 2019), and help adolescents acquire the ability to manage interpersonal conflicts (de Wied et al., 2007). In other words, the well-being of adolescents, including their experienced social anxiety level, is largely dependent upon their relationships and interactions with peers (Brown & Larson, 2009).

It is thus important to pay special attention to these two developmental changes (i.e., socio-cognitive maturation and changes in the peer context), to understand the major increase in social anxiety symptoms during adolescence. In this dissertation, I have focussed on two specific risk factors: cognitive biases and social status within the peer group, which are products of socio-cognitive maturation and the social contextual changes respectively. In addition, I have taken the first step in understanding how these risk factors separately contribute to the development and maintenance of social anxiety in adolescence.

## **THE ROLE OF COGNITIVE BIASES IN SOCIAL ANXIETY**

According to the cognitive schema theory of Beck (1976), every individual has certain cognitive schemas in their mind revolving around how they perceive the world. These schemas entail different cognitive processes such as the selection and encoding of information, the interpretation of cues, and the memory of events. For some individuals, however, these schemas are rather negative and maladaptive, which are referred to as negative cognitive biases. As described

earlier, adolescence is a sensitive period for fine-tuning existing or developing new adaptive or maladaptive cognitive schemas due to the socio-cognitive maturation that takes place during this age period.

Cognitive theories assume that cognitive biases are an important (if not causal) factor contributing to the onset and development of different psychological disorders, including social anxiety (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). Although longitudinal studies investigating this proposition yielded mixed results (Muris et al., 2003; Warren et al., 2000), experimental studies indicate that the assumption of a causal role of cognitive biases in social anxiety may be correct (See et al., 2009; Wilson et al., 2006).

Many different cognitive biases exist but attention bias and interpretation bias are the most consistently detected biases playing a role in social anxiety (Pergamin-Hight et al., 2016). Negative attention bias is often described as the automatic tendency to direct attention toward potentially threatening stimuli in the environment, such as angry-looking peers. Specifically, a negative attention bias consists of the fast detection of threat (i.e., enhanced engagement to threat), and/or the difficulty to withdraw one's attention from threat (i.e., the slow disengagement from threat; Blicher et al., 2020). The role of the different attention bias components in social anxiety in adults is well-established (e.g., Liang et al., 2017) but its role in adolescents is far from clear. Some studies found no significant link between attention bias and anxiety (Kindt & Brosschot, 1999; Morren et al., 2004) but other studies did find evidence for the enhanced engagement to threatening stimuli such as negative emotional faces of youth (Puliafico & Kendall, 2006; Roy et al., 2008; Telzer et al., 2008). Yet another study only found an attention bias towards angry faces for adolescents with severe social anxiety symptoms but not for youth who only experience mild symptoms (Waters et al., 2011).

Interpretation bias, on the other hand, is a more conscious bias and changes the evaluation of a cue. Negative interpretation bias entails the tendency to interpret ambiguous social situations in a negative way (Mathews & MacLeod, 2005). Socially anxious youth interpret social situations as more negative than their non-anxious controls (Miers et al., 2008; Rozenman et al., 2014). Interpretation bias is consistently found as an important (causal) factor contributing to an increased risk of social anxiety, both in adults (Chen et al., 2020), as well as in children and

adolescents (Stuijzand et al., 2018). The link between interpretation bias and social anxiety was found to become stronger with increasing age (Stuijzand et al., 2018), stressing the importance of the early detection of interpretation bias.

### **The combination of different cognitive biases**

The role of attention bias and interpretation bias in social anxiety is often studied separately. This is surprising as the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006) suggests that different biases do not operate in isolation but are rather interrelated and directly influence each other. More negative attention bias is related to more negative interpretation bias, and vice versa. Not only a direct relation between attention bias and interpretation bias is suggested according to the CCBH but different cognitive biases are also assumed to interact with each other when predicting psychological disorders. In other words, the impact of the combination of biases may be larger than the impact of individual biases (Hirsch et al., 2006). The CCBH is based upon the idea of Neisser (1967) that cognitive processes mutually reinforce each other through a cyclical process.

Despite this clear theoretical assumption, most research into socially anxious youth so far focused on either one of the biases (e.g., Vassilopoulos & Banerjee, 2008; Waters, Mogg, et al., 2008), or, if they did investigate both biases simultaneously, did not focus on their direct interrelation or interaction (e.g., Klein, de Voogd, et al., 2018; Waters, Wharton, et al., 2008). However, there is some evidence for the CCBH as research with children and adolescents found a positive association between attention bias and interpretation bias in different anxiety disorders (Rozenman et al., 2014; Watts & Weems, 2006). A recent meta-analysis also supported the CCBH in anxiety as attention bias and interpretation were correlated and could modify each other by training, though these effects were small (Leung et al., 2022). Despite these valuable results, longitudinal studies investigating the interaction and predictive magnitude of attention bias and interpretation bias on youth anxiety are missing. A formal test of the CCBH for social anxiety in adolescents is yet to be provided.

Up until now, attention bias is often measured using tasks with visual stimuli (e.g., pictures of emotional faces; Roy et al., 2008), while interpretation bias is typically assessed using verbal tasks (e.g., verbal vignettes of social ambiguous scenarios; Miers et al., 2008). The use of visual versus verbal stimuli may have complicated the possibility to investigate the supposed link between different cognitive biases.

Hence there is a need for comparable cognitive bias tasks to assess both attention bias as well as interpretation bias, ideally in the same modality. An attempt for this has already been made for adult studies, with two studies integrating attention bias paradigms in a standard verbal interpretation task. Specifically, participants completed a scrambled sentence task to see whether they would complete the sentence positively or negatively (as an indication of interpretation bias) and tracked the time spent on the positive versus negative words (as an indication of attention bias) (Sanchez et al., 2015; Sanchez-Lopez et al., 2019). Contrary to these adult studies, no such task exists yet for adolescents.

### **Contribution of the current dissertation to the study of the role of cognitive biases in social anxiety**

While theories show an important role of attention bias and interpretation bias in the onset and maintenance of social anxiety, longitudinal evidence is limited. Most studies are cross-sectional (e.g., Rozenman et al., 2014; Waters et al., 2011) or experimental (e.g., Seefeldt et al., 2014; Vassilopoulos et al., 2009), making it difficult to draw any conclusions about the predictive impact of cognitive biases on social anxiety. At the same time, most studies ignored the notion of the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006), and instead only focused on either one of the biases (e.g., Bögels & Zigterman, 2000; Miers et al., 2008; Salum et al., 2013). Studies investigating the role of different types of cognitive biases in social anxiety in adolescents specifically are limited (with the exception of Rozenman et al., 2014; Watts & Weems, 2006). Finally, attention bias is a complex phenomenon consisting of different aspects, both the enhanced engagement to threat as well as the difficulty with disengagement from threat (Blicher et al., 2020). Up until now, most studies examined only one attention bias type (e.g., Shechner et al., 2013) or used tasks that are unable to distinguish the different components (e.g., the dot-probe task; Clarke et al., 2013; Koster et al., 2004).

In the first part of this dissertation, I focused on examining the role of cognitive biases in social anxiety, addressing the limitations mentioned above. In the study described in Chapter 2, I investigated the longitudinal link between attention bias (both looking at enhanced engagement to threat and at difficulty with disengaging from threat), interpretation bias, and social anxiety across adolescence, hereby testing the interrelation and interaction between different biases. In the study

described in Chapter 3, an attempt has been made to develop a new social picture task to assess interpretation bias (the Schloss Einstein-Radboud Social Ambiguous Images [SERSAI] task), which is more closely related to the visual measures often used to assess attention bias. Developing such a task may improve the current methodology and facilitate research looking at the interrelation and interplay between different cognitive biases.

## **THE ROLE OF SOCIAL STATUS IN SOCIAL ANXIETY**

The second part of this dissertation focuses on social status as a risk factor for social anxiety in adolescents. Adolescence is a sensitive period when it comes to social developmental changes. As mentioned above, adolescents often experience an educational transition, entering a new peer context in which they prefer to make a good impression on others (LaFontana & Cillessen, 2010; Pellegrini & Long, 2002). Similarly, adolescence is characterized by an increase in the importance of peers in their social and emotional well-being (Brown & Larson, 2009).

Social status comprises two different aspects: popularity, linked to dominance, power, and visibility; and likeability reflecting aspects such as affiliation, intimacy, and support (Cillessen & Marks, 2011; Wiggins, 1991). Popularity and likeability are distinct concepts (Cillessen & Rose, 2005), with their correlation only being low to moderate in adolescence (van den Berg et al., 2020). Popular adolescents are thus not necessarily the well-liked classmates, and well-liked adolescents are not automatically popular. Popularity and likeability also differentially relate to other behavioural constructs, suggesting that they are distinct. For instance, while well-liked adolescents show low levels of aggression, popular adolescents are engaging in aggressive behaviour (Cillessen & Marks, 2011). Having a low peer status can have severe outcomes, for instance, low likeability and low popularity are found to be related to victimization (de Bruyn et al., 2010). Both likeability and popularity are highly stable during adolescence (Lu Jiang & Cillessen, 2005; Marks et al., 2012), so once individuals obtained a low peer status, they are unlikely to improve their status.

Previous research has consistently indicated distortions in both domains for individuals with SAD (Aderka et al., 2009). More specifically, these individuals are described as being lower in rank (i.e., low popularity), and they reported lower quality of intimate relationships with peers and friends (i.e., aspects related to low

likeability; Kearney, 2005). Also, individuals with low social status are more likely to report feelings of social anxiety (Inderbitzen et al., 1997).

## **Popularity versus likeability**

Although both concepts of social status are found to be related to social anxiety, it seems plausible that the association with social anxiety may be larger for popularity than likeability based on previous research and theory. Specifically, in their model, Gilbert & Trower (2001) assume the existence of two psychological systems which enable a social order in a group of people: the social rank system and the safety system (sometimes also called the affiliation system; Weisman et al., 2011). The social rank system is evolved around a biological perspective in which the environment has a limited amount of resources (e.g., food, sexual partners). Individuals with a more dominant place in the hierarchy have greater access to these resources. By using the social rank system, individuals continuously evaluate their place in the hierarchy to retrieve resources. Contrary, the safety system guides individuals to seek cooperation and connection with others to get access to resources (Aderka et al., 2009; Weisman et al., 2011). Relating this theoretical framework to peer relationships in adolescence, it seems as if the social rank system is more related to popularity, while the safety system is linked to likeability.

Research has found that socially anxious individuals over-utilize the social rank system. They hierarchically perceive the world and view others mainly as competitors. Individuals suffering from social anxiety have relatively low self-esteem and thus consider themselves inferior to their peers. They believe that they are unable to compete directly with high-status peers for certain resources. As an alternative, they actively try to avoid harm, rejection, or being passed over by peers by behaving in a submissive and appeasing way (Aderka et al., 2009; Gilbert & Trower, 2001; Weisman et al., 2011). As a result of this behaviour, socially anxious adolescents often acquire a low position in the social hierarchy, which is related to low popularity. The reason why the likeability status of socially anxious individuals may be less affected (Sandstrom & Cillessen, 2006), is because their submissive and appeasing behaviour (Catarino et al., 2014; Gilbert, 2014) may not damage the ability to initiate and maintain friendships (Rodebaugh et al., 2015; Rose et al., 2011). Research supported this theoretical framework as socially anxious individuals were seen as less popular but not as less liked by their peers



(Dijk et al., 2018). Socially anxious individuals are known for the misperception of their likeability status: they often believe that they are less liked by others, but this is not the case as they are equally liked (Christensen et al., 2003; Voncken et al., 2020), or even more liked than non-anxious peers (Baartmans et al., 2019).

Another reason why popularity would be more strongly related to social anxiety than likeability is the idea that unpopularity is more socially threatening than being disliked. This is caused by the fact that often the entire peer group agrees on the (un)popularity status of individuals, while likeability status may be more of a dyadic process (Lansu & Cillessen, 2012; Marks et al., 2012). If an adolescent is in general disliked by others, they may still have some friends, and having friendships is a well-known protective factor for developing social anxiety (Ia Greca & Harrison, 2005). Being classified as unpopular may be more socially threatening as it reflects group consensus, while peer nominations on being disliked may be less unanimous (Cillessen & Marks, 2011). Research indirectly supported this idea as unpopularity was more strongly related to social threats and negative outcomes such as victimization, social withdrawal, loneliness, and having fewer friends than adolescents who were disliked (Hopmeyer Gorman et al., 2011).

### **Cognitive versus behavioural social anxiety symptoms and their link to social status**

There is reason to assume that the link between behavioural symptoms of social anxiety (i.e., social avoidance and withdrawal) and social status components is stronger than the link between cognitive symptoms (i.e., fear of negative evaluation) and social status. The explanation for this idea is rather simple: behavioural symptoms are observable to peers, while cognitive symptoms are not. Therefore, the impact of socially anxious behaviour on peer relationships, including social status, is more direct and stronger than the impact of cognitive symptoms. By avoiding social situations (i.e., an example of behavioural social anxiety symptoms), the opportunities to socialize with peers become automatically limited and this may eventually lead to poor social skills (Greco & Morris, 2005) or difficulties with peer interactions (Clark & Wells, 1995). As a result, individuals showing behavioural social anxiety symptoms may be perceived as less attractive interaction partners, leading to an increased risk for negative peer evaluations and a low social status (Alden & Taylor, 2004; Bruch & Cheek, 1995; Dodge & Feldman, 1990).

There is an ongoing debate whether individuals with SAD indeed have a social skills deficit or whether their social performance is disrupted because of their anxiety (Lange et al., 2014; Schneider & Turk, 2014). Nevertheless, previous studies showed that individuals with SAD are evaluated as more negative by others (Heerey & Kring, 2007; Voncken et al., 2008). Specifically, certain behaviours of socially anxious individuals, such as self-talk, nervous fidgeting, and reassurance seeking were experienced as negative by the interaction partners. It is also suggested that subtle behavioural deviations such as avoiding eye contact can lead to actual devaluations of individuals suffering from SAD, leading to a self-fulfilling prophecy (Lange et al., 2014). Hence, based on these results, it can be concluded that behavioural symptoms of social anxiety have a direct effect on the social status of adolescents.

Empirical evidence supports the notion that the link between social status and behavioural symptoms is stronger than with cognitive social anxiety symptoms. Specifically, cross-sectional research showed a link between lower popularity and likeability status among peers and more avoidance and withdrawal behaviour from peer interactions (Pouwels et al., 2016). Also, low peer acceptance is more strongly related to social avoidance and distress during situations, than to trait fear of negative evaluation (la Greca & Lopez, 1998). Finally, a cross-sectional study showed that only individuals showing behavioural symptoms such as social withdrawal, experience peer victimization, and low peer acceptance, while individuals only suffering from cognitive symptoms of social anxiety do not experience such peer difficulties (Flanagan et al., 2008).

## **The transactional model**

Different models have been developed to explain the interplay between social status and social anxiety in general, without distinguishing between the specific subcomponents (i.e., popularity, likeability, cognitive and behavioural social anxiety symptoms). The interpersonal risk model, on the one hand, assumes that negative peer relationships increase the risk of social anxiety, as social anxiety mainly develops if the social environment is negative, for instance by conflicting and unsupportive relationships. These relationships may be stressful for adolescents as they interfere with the basic human need to belong and the need for support, resulting in an increase in mental problems, including social anxiety (Kochel et al., 2012; Sentse et al., 2017). Previous research showed support for the interpersonal risk model, as it was found that children with a low social status had an increased

risk of hospitalizations for anxiety thirty years later (Modin et al., 2011). Also, when having more close friends, social anxiety symptoms decreased in adolescents, mediated by the perceived care of these friends (van Zalk & van Zalk, 2015).

The symptoms-driven model, on the other hand, assumes that socially anxious adolescents cause, at least to some extent, problematic peer relationships themselves. For instance, individuals with social anxiety may have a lack of appropriate social skills, may choose maladaptive friendships, or are easy targets for victimization due to their internalizing behavioural style (Kochel et al., 2012). In concordance with the symptoms-driven model, the social skills of socially anxious adolescents were rated as poor by their peers (Miers et al., 2010) and adolescents experienced an increase in social anxiety over time when they self-selected friends who experienced similar levels of social anxiety (van Zalk, van Zalk, Kerr, et al., 2011). Similarly, socially anxious individuals were less accepted by their peers five months later (Biggs et al., 2010).

Both the interpersonal risk model and the symptoms-driven model have been integrated into the transactional model (Morris, 2001; Ollendick & Hirshfeld-Becker, 2002). The transactional model suggests that social status and social anxiety may be bidirectionally related to each other. Based on the model it could be assumed that social anxiety triggers negative peer relationships, which in turn increase feelings of social anxiety (Kochel et al., 2012; Parker et al., 2005). There is some indirect empirical evidence for the transactional model as the studies discussed above found support for both the interpersonal risk model (Modin et al., 2011; van Zalk & van Zalk, 2015) as well as the symptoms-driven model (Biggs et al., 2010; Miers et al., 2010; van Zalk, van Zalk, Kerr, et al., 2011). Up until now the different directions of the relationship were examined in separate studies, and this asks for an approach in which both directions can be tested simultaneously to provide a more accurate test of the transactional model.

### **Contribution of the current dissertation to the study of the role of social status in social anxiety**

Based upon the theoretical suggestions and empirical evidence described above, it seems important to distinguish between popularity and likeability, and to differentiate between cognitive and behavioural symptoms of social anxiety. Although research did make efforts to test the individual effects of popularity and likeability, most studies focused on social anxiety as one general construct. At the same time, to date, there is

no study investigating all subcomponents of social status (i.e., popularity, likeability) and social anxiety (i.e., cognitive and behavioural symptoms) simultaneously. This may have resulted in an unclear or distorted picture of the link between social status and social anxiety. Besides, longitudinal evidence is limited but this is necessary to be able to formally test the transactional model and investigate whether social status and social anxiety are bidirectionally related to each other.

The second part of my dissertation, therefore, concentrates on the role of social status in social anxiety. The studies described in Chapters 4 and 5 of the current dissertation tried to fill the research gaps mentioned before and aimed to obtain a more detailed understanding of the longitudinal relationship between specific social status components (i.e., likeability and popularity) and social anxiety symptoms (i.e., cognitive and behavioural symptoms). Both directions of the relationship between social status and social anxiety are investigated in one model, hence testing the applicability of the transactional model.-

## **THE LINK BETWEEN COGNITIVE BIASES AND SOCIAL STATUS**

In this dissertation, I investigated how cognitive biases and social status separately contribute to the development and maintenance of social anxiety in adolescence. However, in reality, these two factors may probably interact with each other. According to Bronfenbrenner's ecological theory, there is an ongoing interaction between individual factors (i.e., adolescent characteristics) and the context in which adolescents are situated (e.g., peers, parents, schools), when predicting developmental outcomes, including social anxiety (Bronfenbrenner & Morris, 2006). Placing cognitive biases and social status in the context of Bronfenbrenner's theory, it would appear that cognitive biases can be seen as an individual risk factor and social status could function as a contextual risk factor for social anxiety (see Figure 2a). Both risk factors are continuously interacting with each other (shown by the bidirectional arrows in Figure 2a), and probably the combination of risk factors predicts the biggest increase in social anxiety feelings and behaviours. This dissertation is aimed at testing part of the model by disintegrating the risk factors. In other words, as a first step, I investigated how these individual and contextual risk factors are separately related to social anxiety in adolescence (see Figure 2b). Future research could benefit from investigating the interaction between these different risk factors to understand the development of social anxiety in more detail.

**Figure 2** The conceptual model of the interaction between cognitive biases and social status predicting social anxiety in adolescence, based upon Bronfenbrenner's ecological theory (1979-2005) (Figure 2a). The tested model of the current dissertation with cognitive biases and social status as separate risk factors of social anxiety in adolescence (Figure 2b).

Figure 2a

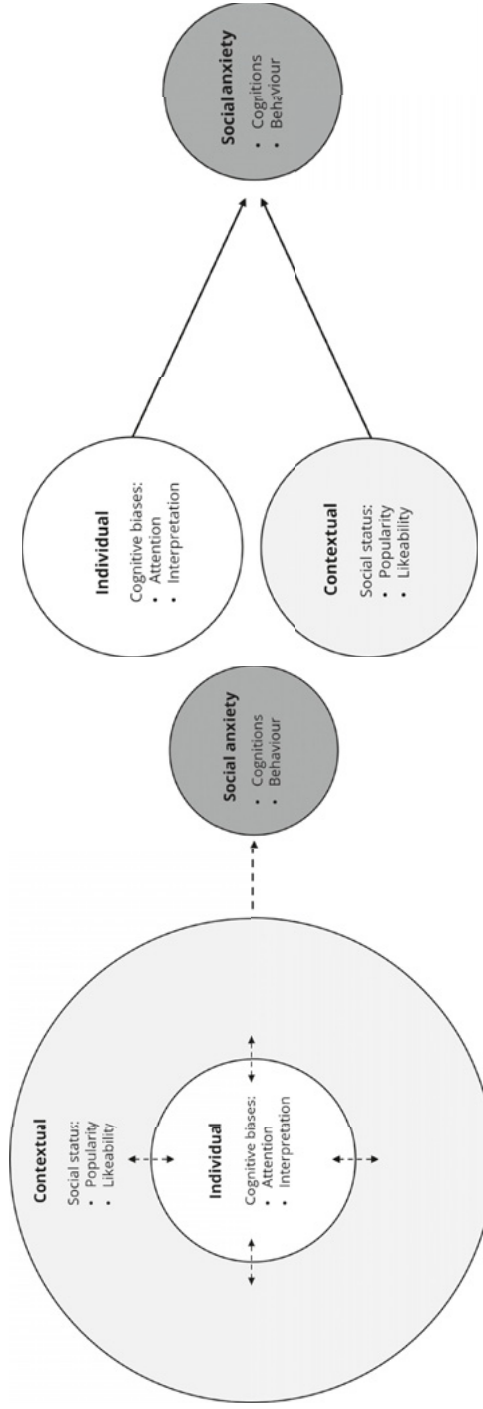
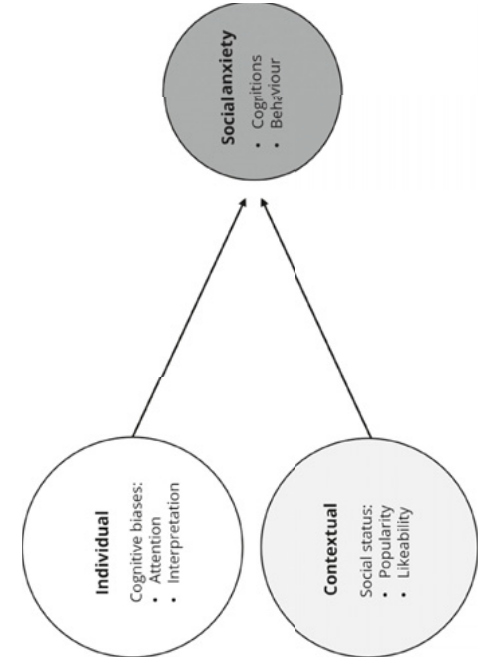


Figure 2b



Note. Solid arrows represent tested relationships of the current dissertation, dashed arrows are hypothesized relationships not tested in this dissertation.

## AIMS AND OUTLINE OF THE DISSERTATION

The overarching aim of this dissertation was to better understand which factors contribute to the development and maintenance of social anxiety in adolescence, the most critical age period for the exacerbation of social anxiety (Beesdo et al., 2011). Specifically, this dissertation constituted of two research lines to investigate the role of individual risk factors: cognitive biases (Chapters 2 and 3) and the role of a contextual factor: social status (Chapters 4 and 5) in social anxiety.

**Chapter 2** focused on studying the longitudinal relationship between attention bias, interpretation bias, and social anxiety during three years of adolescence ( $N = 816$ , aged 11-16 years old). Specifically, I examined how attention bias and interpretation bias predict social anxiety levels. Also, this study provided an empirical test of the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006), as it investigated both the direct interplay between attention bias and interpretation bias, as well as their interaction when predicting social anxiety throughout adolescence. This study also provides a critical review of the current paradigms to assess attention bias in adolescents.

In the study described in **Chapter 3**, I developed a new interpretation bias task using ambiguous pictures of adolescents' everyday social scenes (the Schloss Einstein-Radboud Social Ambiguous Images [SERSAI] task). Such a pictorial task may increase ecological validity and readily trigger emotional processes compared to more traditional, text-based tasks which are often used. At the same time, by developing a pictorial task, the interpretation bias measure becomes more comparable to conventional attention bias tasks which also often use pictorial stimuli. This allows for a better investigation of the link between different biases and the testing of the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006). Specifically, I tested how the new pictorial task, the SERSAI task, was related to a well-established and often used interpretation bias task and to social fears in adolescents ( $N = 329$ , aged 12-18 years old).

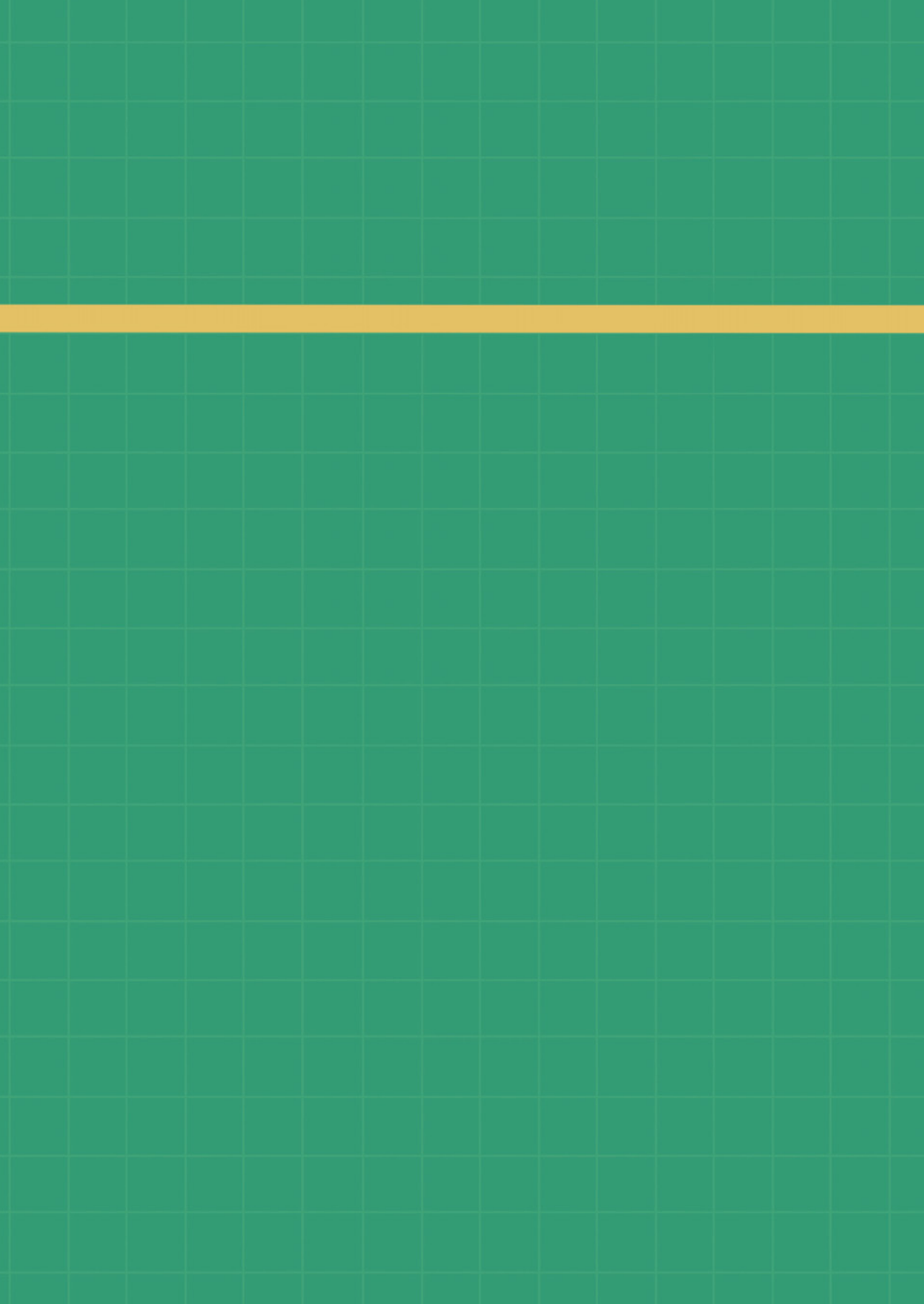
The studies described in **Chapters 4 and 5** both addressed the same research aim, namely, to understand how specific subcomponents of social status (i.e., likeability and popularity) and social anxiety (i.e., more cognitive and behavioural symptoms) are longitudinally related during adolescence. Additionally, gender differences in these associations were explored. The research designs of both studies were

however different. In **Chapter 4** I investigated the relationship between social status and social anxiety during one school year by including two measurement waves with a 6-months interval ( $N = 274$ , aged 11-15 years old). Social status was assessed by peer nominations and a self-report questionnaire was used to measure the different social anxiety symptoms. In **Chapter 5** I examined this relationship during a larger developmental period of three consecutive years, with a larger adolescent sample ( $N = 174$ , aged 11-17 years old). Social status components were again measured via peer nominations, and although cognitive symptoms of social anxiety were assessed in a similar way as in Chapter 4, I also used peer nominations to get a more objective indication of adolescents' behavioural anxiety symptoms. By using these different research designs, I could eliminate confounding methodological explanations and draw stronger conclusions about the link between social status and social anxiety across adolescence.

Finally, in **Chapter 6**, the findings of all reported studies are summarized and integrated into a comprehensive framework. The meaning, relevance, and implications of the studies are discussed while taking the strengths and limitations into account. In this chapter, I also highlight important directions for future research.







# Chapter 2

## The longitudinal interplay between attention bias and interpretation bias in social anxiety in adolescents

## ABSTRACT

Cognitive biases are found to play a role in the onset and maintenance of social anxiety. However, particularly in adolescence, the link between different biases and their role in predicting social anxiety is far from clear. This study, therefore, investigated the interplay between attention bias and interpretation bias in relation to social anxiety in adolescence across three years. 816 adolescents in grades 7 to 9 participated in three yearly waves (52.8% boys,  $M_{\text{age grade7}} = 12.60$ ). Social anxiety was measured with a self-report questionnaire. Attention bias was measured with a visual search task with emotional faces. Verbal vignettes assessed interpretation bias. Cross-lagged models showed that negative interpretation bias in grade 7 predicted an increase in social anxiety in grade 8. This effect was not found in grades 8 to 9. Attention bias did not predict social anxiety. Attention bias and interpretation bias were not longitudinally related to each other, nor did they interact with each other in predicting social anxiety. Thus, no evidence was found for the Combined Cognitive Bias Hypothesis in social anxiety in adolescents. Instead, our results suggest that interpretation bias rather than attention bias contributes to the increase of social anxiety over time.

**Keywords:** social anxiety; attention bias; interpretation bias; longitudinal; adolescence

## INTRODUCTION

Social anxiety involves the fear to be negatively evaluated by others and is often accompanied by the avoidance of social situations (American Psychiatric Association, 2013). Social anxiety has its onset in childhood (Beesdo et al., 2011) but symptoms increase during adolescence with a prevalence of 5-16% (Mesa et al., 2011). Youth with social anxiety experience severe consequences such as the increased risk of peer victimization (Erath et al., 2007), depression, and substance use (Beesdo et al., 2007). Early detection and treatment are therefore warranted, highlighting the necessity of research on factors contributing to the onset and maintenance of social anxiety.

Many cognitive models assume that biased cognitive processing is a contributing factor (e.g., Beck et al., 2005; Wong & Rapee, 2016). Specifically, negative attention bias (i.e., the attentional preference for negative stimuli) and negative interpretation bias (i.e., the tendency to negatively interpret ambiguous social situations) increase the risk of experiencing social anxiety symptoms in children and adolescents (Dudeny et al., 2015; Stuijzand et al., 2018). Most studies on children and adolescents so far have been cross-sectional (e.g., Rozenman et al., 2014; Seefeldt et al., 2014; Vassilopoulos et al., 2009; Waters et al., 2011), making it difficult to conclude the long-term predictive impact of biases on social anxiety. Exceptions are made for two longitudinal studies. One of these studies showed that adolescents with a negative interpretation style are at higher risk for belonging to a high social anxiety trajectory (Miers et al., 2013). The other study provided evidence that social anxiety was able to predict negative interpretation bias two years later. However, interpretation bias could not explain the pathway between shyness and social anxiety over time (Blöte et al., 2019). Longitudinal evidence about the role of attention bias is still lacking. At the same time, most studies on youth investigated the effect of either one of the biases on social anxiety (e.g., Bögels & Zigterman, 2000; Miers et al., 2008; Salum et al., 2013), thereby ignoring the fact that biases may be interrelated or interact with each other (Hirsch et al., 2006). To overcome these limitations, the current study focuses on the interplay between attention bias and interpretation bias and examines the longitudinal predictive ability of cognitive biases on social anxiety across three years of adolescence.

## **Attention bias, interpretation bias, and social anxiety**

Both attention and interpretation biases may play a role in the existence and development of social anxiety in adolescence. Following the theory of Piaget (1971), adolescence, in particular, could be a critical period for the development of cognitive biases, as a result of socio-cognitive maturation. Adolescents become able to think and reason abstractly and develop metacognitive beliefs (i.e., the ability to reflect on their thoughts and behaviours; Weil et al., 2013). This cognitive maturation may result in heightened self-consciousness and concerns about self-presentation, and the development of cognitive biases (Rapee & Spence, 2004; Westenberg et al., 2004).

Attention bias is a complex phenomenon consisting of multiple components. On the one hand, it is characterized by an enhanced engagement to threat as (socially) fearful individuals are faster to detect negative stimuli in the environment. On the other hand, it encompasses the delayed disengagement from threat, which is described as the difficulty to withdraw one's attention from negative cues (Blicher et al., 2020). Most studies on attention bias in anxious youth focus on one specific attention bias component (e.g., enhanced engagement to threat; Shechner et al., 2013) or use a task that is not able to distinguish between the different attention bias components (e.g., the dot-probe task; Clarke et al., 2013). In this study, we aimed to examine both attention bias components by using a visual search task instead in which participants in different trials either have to detect or ignore a social threat. As such, we could investigate whether attention biases in social anxiety are associated with biases in engagement or disengagement (Donnelly et al., 2010).

Despite the theoretical frameworks and the fact that adult studies continuously found evidence for the role of engagement and disengagement attention biases in social anxiety (Liang et al., 2017), the role of attention bias and its specific components in youth is less clear. A review paper showed that some studies failed to detect a link between attention bias and anxiety in children, including social anxiety (Dudeny et al., 2015; Puliafico & Kendall, 2006) but others showed that socially anxious youth are faster at detecting threatening stimuli such as negative emotional faces (Roy et al., 2008; Schmidtendorf et al., 2018; Seefeldt et al., 2014; Waters et al., 2011). Meta-analyses comparing attention bias in youth and adults are also inconclusive: one found attention bias to be similar across different age

groups (Bar-Haim et al., 2007), while another concluded that anxious children show attention bias to a lesser degree than adults (Dudeny et al., 2015). Actually, in line with the idea of socio-cognitive maturation (Piaget, 1971), the association between attention bias and anxiety increased with increasing age in children, with adolescence being a critical period for a possible persisting role of attention bias (Dudeny et al., 2015).

Contrary to attention bias, there is ample evidence for the role of interpretation bias in social anxiety. Recent meta-analyses for adults (Chen, Short, & Kemps, 2020), as well as children and adolescents (Stuijzand et al., 2018), concluded that a negative interpretation bias was related to an increased risk of experiencing anxiety symptoms, including social anxiety. Furthermore, socially anxious children and adolescents were more likely to interpret social situations in a threatening manner than non-anxious individuals (Miers et al., 2008; Rozenman et al., 2014). Similar to the findings of attention bias, and in line with the theory of Piaget (1971), the link between interpretation bias and anxiety also seems to increase in strength from childhood to adolescence (Stuijzand et al., 2018). This highlights the importance of focusing on cognitive biases during adolescence.

Studies regarding cognitive biases in social anxiety varied on whether the sample was unselected (i.e., a community sample), highly trait anxious, or clinically diagnosed with social anxiety disorder. Different meta-analyses on attention bias and interpretation bias in adults, children, and adolescents found that the variation among effect sizes of different studies was not accounted for by the level of social anxiety symptoms as a sample characteristic (Bar-Haim et al., 2007; Chen et al., 2020; Stuijzand et al., 2018). In other words, the strength of the link between attention bias and interpretation bias with social anxiety was similar for non-clinically as well as clinically anxious individuals. Cognitive biases were comparable across different types of anxious populations. In our study, we focus specifically on a community sample of adolescents to be able to investigate the relative contribution of attention bias and interpretation bias in the development of social anxiety symptoms.

## **Combined Cognitive Bias Hypothesis**

Attention bias and interpretation bias are often studied as two separate constructs, having their independent impact on social anxiety. However, the Combined

Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006) assumes that biases do not operate in isolation. The idea of the CCBH comes from Neisser (1967) who suggested that cognitive processes are cyclical, thus mutually reinforcing each other. Instead of acting alone, attention bias and interpretation bias are expected to be interrelated and influence each other. Different biases may interact in such a way that the combination of attention bias and interpretation bias is expected to have a greater impact on social anxiety than individual cognitive biases alone.

However, most studies on youth so far investigated the effects of different biases separately (Vassilopoulos & Banerjee, 2008; Waters, Mogg, et al., 2008). Even if attention bias and interpretation bias were investigated simultaneously, the interrelation and interplay between biases were often ignored in studies on youth (Klein, de Voogd, et al., 2018; Waters, Wharton, et al., 2008). There are two exceptions to studies showing a positive link between attention and interpretation bias in different types of youth anxiety, including social anxiety (Rozenman et al., 2014; Watts & Weems, 2006). In both studies, attention bias was assessed using a dot-probe task (either with pictures of emotional faces, Rozenman et al., 2014; or with threatening words and drawings of angry faces, Watts & Weems, 2006). In the study of Rozenman et al. (2014), interpretation bias was measured using a word-sentence association paradigm in which threatening/neutral words appeared, with an ambiguous sentence following the word. Adolescents were prompted to indicate whether the word and sentence were related. Watts & Weems (2006) used an ambiguous vignette task to measure interpretation bias. Although results showed a clear relationship between attention and interpretation bias, both of these studies were cross-sectional, hereby overlooking the predictive magnitude of biases on social anxiety, and did not take into account the interaction between different biases, so did not formally test all aspects of the CCBH.

In sum, while it is generally acknowledged that interpretation bias may play an important role in maintaining, if not causing, social fears, the role of attention bias in social anxiety in adolescents is less clear. At the same time, the combined role of attention bias and interpretation bias during adolescence is only scarcely investigated. The current study is set up to overcome this caveat by investigating how attention bias and interpretation bias relate to each other, and whether they individually and/or mutually predict social anxiety throughout adolescence. Understanding the interplay between biases may also have clinical implications.

While Cognitive Bias Modification (CBM) techniques are prevailing as adjunct treatments to classical psychological treatments, modifying only one bias type without addressing other underlying biases may be insufficient. This might be the reason why current CBM techniques do not unequivocally lead to successful reductions of psychological symptoms in youth (Platt et al., 2017).

Evidence regarding the effectiveness of combined CBM, in which both attention bias and interpretation bias were targeted, is mixed. One study showed that the effect of combined CBM on decreasing social anxiety in adolescents 6 months later, was only marginally significant (Sportel et al., 2013). However, there are also studies showing the utility of combined CBM. For instance, adults receiving such a combined CBM reported reduced social anxiety symptoms, and this was also shown in a behavioural speech task (Beard et al., 2011). Similarly, there is some preliminary evidence for socially anxious adolescents to show reductions in social anxiety, negative social behaviour, general anxiety, and depression after receiving both attention and interpretation training (Lisk et al., 2018). However, both of these studies did not include an active control condition (e.g., a single CBM training), limiting the interpretation of the effects. Thus, more evidence for the combined effect of different cognitive biases on social anxiety is needed to guide clinical practice on whether targeting multiple biases is necessary for effective treatment.

## **Current study**

The current study aimed to investigate how attention biases (both enhanced engagement and delayed disengagement) and interpretation bias predicted social anxiety symptoms during three years of adolescence. Additionally, we tested the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006) by investigating how different biases are related, and whether attention biases and interpretation bias individually predict social anxiety, or whether they interact with each other. Self-esteem and loneliness were included as covariates as they have been found to be related to these biases in adults and youth (Lau et al., 2021; Tran et al., 2011), and to social anxiety in youth (Maes et al., 2019; van Tuijl et al., 2014).

First, we hypothesized that negative attention biases (enhanced engagement and delayed disengagement) and interpretation bias will each independently predict social anxiety one year later. Individuals who are faster to detect negative stimuli (i.e., enhanced engagement), or are slower to withdraw their attention from



negative stimuli (i.e., delayed disengagement), or individuals with a higher negative interpretation bias will experience higher levels of social anxiety at a later time point.

Second, regarding the CCBH, we expected that attention biases (enhanced engagement and delayed disengagement) and interpretation bias will be positively and bidirectionally related to each other. That means that individuals who are faster to detect negative stimuli (i.e., enhanced engagement) or are slower to withdraw their attention from negative stimuli (i.e., delayed disengagement) will show higher negative interpretation bias at a later time point. Vice versa, individuals with higher negative interpretation bias will have higher negative attention biases at a later time point (they experience enhanced engagement to or delayed disengagement from negative stimuli).

Third, we expected attention biases (enhanced engagement and delayed disengagement) and interpretation bias to positively interact with each other when predicting social anxiety over the course of adolescence. Thus, the combined effect of attention biases and interpretation bias on social anxiety is expected to be larger than if biases act alone.

## **METHODS**

### **Sample**

This study is part of the Kandinsky Longitudinal Study (KLS), an ongoing longitudinal study with yearly assessments in secondary schools in the Netherlands since 2010. The KLS investigates the social and emotional functioning of adolescents from grades 7 to grade 10 at a secondary school in the Southeast area of the Netherlands (i.e., the first through the fourth year of secondary education in the Netherlands). For this study, we use data from the waves in 2017, 2018, and 2019 as these were the waves in which data on the variables of interest were collected.

In total, 916 adolescents participated. We selected participants who participated in at least one of the waves. Data from students in grade 10 were excluded, because this concerns a subsample of students with a higher educational level, limiting the generalizability to a larger sample. 23 participants repeated a grade. For them, we removed data from the duplicate grade onwards. This resulted in removing two participants completely, as they were absent during the non-duplicate years and had no data left for grades 7, 8, or 9.

Our final sample consisted of 816 participants (52.8% boys). In grade 7, participants were between 11.49 and 14.18 years old ( $M = 12.60$ ;  $SD = 0.42$ ). Information on ethnicity was only collected in 2017, so is present for 474 participants (58.1%). The majority was born in the Netherlands (96.4%) or had parents who were born in the Netherlands (88.2-90.9%). Different educational levels were represented in the sample in grade 7: pre-vocational/pre-college (29.2%), pre-college/pre-university (37.5%), and pre-university (33.3%).

Participants in our sample could be divided into four different cohorts, dependent upon which year they entered high school (see Appendices, Table A). The first cohort consisted of adolescents who entered high school in 2017 and were followed across three years ( $n$  cohort<sub>2017-2019</sub> = 259). The second cohort were adolescents who were already in grade 8 in 2017 and were also assessed when they were in grade 9 one year later, thus were followed for two years ( $n$  cohort<sub>2017-2018</sub> = 242). The third cohort consisted of adolescents who entered high school in 2018 and were in grade 8 in 2019, thus were followed for two years ( $n$  cohort<sub>2018-2019</sub> = 176). The fourth cohort consisted of adolescents who entered high school in 2019 and were thus only participated for one year ( $n$  cohort<sub>2019</sub> = 139). These cohorts did not significantly differ from each other in gender, age, educational level, ethnicity, attention biases, self-esteem, or loneliness in all grades ( $ps > .05$ ). However, there were some mean level differences between cohorts in interpretation bias and social anxiety levels in grade 7,  $ps < .05$  (but not in grade 8 or 9). Yet, more importantly, the associations between variables did not significantly differ between the cohorts (Fisher's  $r$ -to- $z$  transformations with  $p < .001$  as cut-off due to the many comparisons). Therefore, the four cohorts were treated as one sample of 816 adolescents followed from grade 7 to grade 9 (irrespective of the year in which data were collected)<sup>1</sup>.

## Measures

### ***Attention biases***

We created a visual search task with pictures of emotional adolescent faces, similar to the task of de Voogd et al. (2014). These faces were unfamiliar to the participants but represented youths of similar age. Both male and female faces were used

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<sup>1</sup> Differently than stated in the pre-registration, we did not explore whether the longitudinal model differently applied to the four cohorts, because we found no cohort differences in the associations between variables.

but these were shown in separate matrices. A matrix consisted of a 4x3 grid of faces presented on a screen (see Figure 1). All faces either had a happy, angry, or neutral expression, except for one (e.g., one face was looking happy, while the rest showed a neutral expression). This is called the odd-one-out paradigm.

The faces were adapted from the National Institute of Mental Health Child Emotional Faces Picture Set (NIMH-ChEFS; Egger et al., 2011). All pictures were resized, so the matrix fit on the screen. The colour of the outfits of the actors was made black in Adobe Photoshop, to ensure that each picture had similar colour features. Two sets of pictures were selected: one for the practice trials and one for the actual task. Both sets consisted of pictures of 12 male and 12 female actors. For each actor, we had a picture of a happy, angry, and neutral facial expression. All faces were randomly selected and positioned in the grid for each trial.

There were eight different types of trials, in which one matrix of faces was shown: happy in neutral, neutral in happy, angry in neutral, and neutral in angry, all separately for male and female faces. Each type of trial occurred six times, resulting in a total of 48 trials. These 48 trials were divided into two consecutive blocks (24 trials per block), with each trial type occurring three times per block. Participants started with eight practice trials, one for each trial type. During the practice trials, feedback was provided if the response was incorrect, and the same trial was then repeated. Correct responses were thus required before participants could continue. After the practice trials, the actual trials started. Participants had to detect the emotional face in a neutral grid or the neutral face in an emotional grid as fast as possible, by clicking on the face which had a different expression than the others. The matrix was presented until the participant responded, followed by a new trial. Per trial, we measured whether the trial was correct (i.e., the participant clicked on the face which was the odd-one-out) and the latency in milliseconds that it took to click on the face.

We cleaned the reaction time data in a similar way as de Voogd et al. (2014). First, we filtered out all incorrect trials (4.27% of the trials in grade 7, 4.65% in grade 8, and 1.99% in grade 9). Second, we removed all reaction time data of participants who had more than 20% of the trials incorrect (3.68% of the participants in grade 7, 5.15% in grade 8, and 1.72% in grade 9). Third, we removed all fast outlier data: correct trials with a reaction time lower than 200 milliseconds (0.01% of the trials

in grade 7, 0.01% in grade 8, 0.01% in grade 9). Finally, we removed slow outliers, which are correct trials with a latency of two standard deviations or higher than the mean latency of correct trials for their grade (7.97% of the trials in grade 7, 8.68% in grade 8, 5.54% in grade 9).

After cleaning the data, we computed the mean latency of the happy-in-neutral trials, the angry-in-neutral trials, the neutral-in-happy trials, and the neutral-in-angry trials, separately for the two consecutive blocks and the trials with female versus male faces. Pearson correlations between the different blocks ranged across grades between  $r = .40-.54$ . The correlations between male and female trials ranged between  $r = .44-.66$  across grades. We combined the scores for both blocks<sup>2</sup> and the male/female trials<sup>3</sup>.

This resulted in four different mean latency scores: one for the happy-in-neutral trials, one for the angry-in-neutral trials, one for the neutral-in-happy trials, and one for the neutral-in-angry trials. A difference score of the mean latency of the angry-in-neutral trials minus the happy-in-neutral trials was used as an indication of attention bias engagement. Delayed disengagement from threat was computed as the difference score of the mean latency of the neutral-in-happy trials minus the neutral-in-angry trials. We standardized both difference scores. Higher positive scores on these indices represent higher positive biases, higher negative scores higher negative biases, and scores around zero indicate that an adolescent has no attention engagement or disengagement preference.

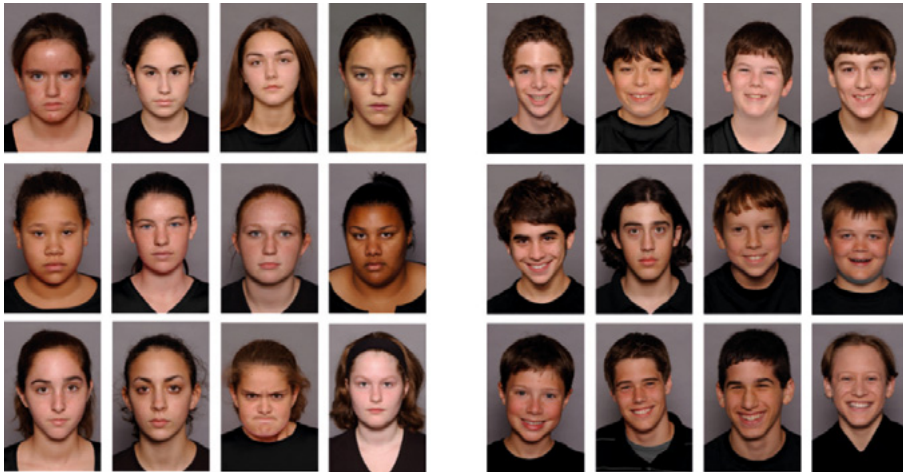
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<sup>2</sup> Exploratory analyses using Wald tests with  $p < .001$  showed that our models similarly apply if only trials from the first or second block were taken into account.

<sup>3</sup> We explored whether the models similarly applied if only male or female trials were included using Wald tests with  $p < .001$  while controlling for participants' own gender. Results were comparable, but there was one difference. Attention bias engagement in grade 7 predicted attention bias engagement in grade 8 more strongly for the female trials than the male trials. This difference was both present for boys and girls.

**Figure 1**

Example trials of the attention bias visual search task with an angry in a neutral female grid (left) and a neutral in a happy male grid (right)



### ***Interpretation bias***

Seven verbal vignettes describing socially ambiguous scenarios were used to assess interpretation bias. Each scenario was accompanied by a positive, negative, and neutral interpretation of the scenario. Adolescents rated for each interpretation type how likely they found this interpretation matching the scenario on a 6-point Likert scale (1 = “*absolutely not*” to 6 = “*absolutely*”). An example is: “*Two classmates talking to each other are looking at you. Why are they looking at you?*” with the following interpretations: “*They tell something nice about me*” (positive), “*They are gossiping about me*” (negative), and “*They happen to be looking in my direction*” (neutral). Three vignettes were adopted from the Adolescents Interpretation and Belief Questionnaire (AIBQ; Miers et al., 2008), one is from the Interpretation and Judgmental Questionnaire (IJQ; Voncken et al., 2003), one is from an interpretation bias task developed by Mobach et al. (2019), and the remaining two vignettes were developed by the authors of the present study. Previous studies consistently detected interpretation bias in individuals with social fears using such verbal vignette tasks (Stuijzand et al., 2018), providing evidence for its adequate psychometric properties. By only including vignettes describing socially ambiguous scenarios, the task was ecologically valid for socially anxious adolescents.

The inter-item reliability was acceptable (Field, 2009), with Cronbach's  $\alpha = .66-.71$  for positive interpretations across grades, and  $\alpha = .72$  for negative interpretations in all grades. To get an indication of interpretation bias, we calculated a difference score between the total score of the positive minus the total score of the negative interpretations. Next, we standardized this difference score. A positive score on this index represents a higher positive bias, a negative score a higher negative bias, and a difference score of around zero indicates that an adolescent has no preference for a certain interpretation type. The neutral interpretations were not used for this calculation as they merely functioned as filler items to ensure that participants were not forced into a higher positive or negative interpretation bias.

### ***Social anxiety***

The Dutch version of the Social Anxiety Scale for Adolescents (SAS-A; la Greca & Lopez, 1998) was used to assess adolescents' social anxiety levels. This questionnaire consists of 18 items. Participants indicated for each item how much it describes themselves via a 5-point scale ranging from 1 = "never" to 5 = "always". An example item is "I worry about what others think of me". In our study, the inter-item reliability of this questionnaire was good (Field, 2009), with Cronbach's  $\alpha = .91-.92$  across grades. We calculated a total score by summing all items and subsequently standardized this score. A higher score indicates higher levels of social anxiety.

### ***Self-esteem***

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) assessed self-esteem (included as a covariate in the analyses). This scale consists of 10 items which had to be answered on a 4-point scale ranging from 1 = "strongly disagree" to 4 = "strongly agree". An example item is "In general, I am satisfied with myself". We reverse-coded half of the items before calculating a total score by summing all items. Next, we standardized this total score, with a higher score indicating higher levels of self-esteem. In our study, the inter-item reliability of this questionnaire was good (Field, 2009), with Cronbach's  $\alpha = .83-.89$  across grades.

### ***Loneliness***

The subscale peer-related loneliness of the Loneliness and Aloneness Scale for Children and Adolescents (LACA; Maes et al., 2015) was used to measure loneliness

(included as a covariate in the analyses). This subscale contains 12 items that had to be answered on a 4-point scale ranging from 1 = “never” to 4 = “often”. An example item is: “*I find that I have fewer friends than others*”. We computed a total score by summing all items and subsequently standardizing the score. A higher score indicates higher levels of loneliness. In our study inter-item reliability was good (Field, 2009), with Cronbach’s  $\alpha = .88-.89$  across grades.

## Procedure

The research questions, hypotheses, and analytic strategy of this study are pre-registered (see <https://osf.io/xq25b/>). Each year, the school director requested the research and claimed responsibility for the parental consent procedure. In 2017 and 2018 passive parental consent was obtained by the school. In 2019 the consent procedure changed, and parents gave active consent. Adolescents gave assent to the study at the start of the assessment each year. Both procedures have been approved by the Institutional Review Board of the Faculty of Social Sciences of Radboud University (approval code for 2018 and earlier waves: ECG2012-2505-038; approval code for 2019 and later waves: ECSW-2018-086).

Data collection took place at school, within a 45 to 60-minute classroom session. Adolescents completed different self-report questionnaires, peer-nomination items (not relevant for the current study), the interpretation bias vignettes, and the attention bias paradigm on individual computers. At least two researchers were present during the assessment in the classroom. Prior to the assessment, one researcher explained the goal and set-up of the study. Participants were explained that the data would be processed anonymously and handled confidentially. Adolescents were asked to keep their answers to themselves and to be truthful in answering all questions.

During the data collection, adolescents sat at a private desk with partitioning screens. They were not allowed to talk to each other during the assessment but could ask questions to the researchers. They could stop at any given moment. Each year, all participants received a small present and several tablets were raffled.

## Missing data

In total, 38.7% of the data was missing. These incomplete data were due to three different types of missing data in our sample. First, there were person-level missings, participants who are missing for an entire grade. This was because they

did not enter high school in 2017 and thus had no data available at all grades (i.e., three of the four cohorts consisted of those participants,  $n = 557$ ), shifted to another school ( $n = 54$ ), were ill at the day of the assessment ( $n = 81$ ), did not receive consent or give assent in a certain grade ( $n = 138$ ), or their data for a grade were removed by us because they duplicated a grade ( $n = 21$ ). Second, there were construct-level missing data, meaning that there is no data for an entire construct at a wave. Participants were present but did not complete the measures within the one-hour classroom session ( $n = 83$ ), or, with regards to attention bias, because they had more than 20% incorrect trials and their data were removed from further analyses ( $n = 86$ ). Third, and finally, there were item-level missings with some items of a variable being completed but others not. Item-level missing was only present for attention bias data and occurred by us removing data of the incorrect trials and outliers. In total 11.04% of the attention bias values were missing.

Attrition analyses using Bonferroni corrections showed that participants with or without missing data did not significantly differ from each other in gender, age, educational level, ethnicity, attention biases, interpretation bias, social anxiety, self-esteem, or loneliness in all grades ( $ps > .05$ ). Little's MCAR test showed that the normed  $\chi^2$  ratio was 1.35 and thus seen as acceptable (i.e.,  $<3$ ; Ulman, 2013). The different missing types were handled according to the guidelines of Newman (2014). For item-level missing, we used the available items to compute a mean score for this construct. For construct-level and person-level missing, we automatically replaced the missing data with the full information maximum likelihood (FIML) estimator in Mplus, version 8.6.

## RESULTS<sup>4</sup>

### Preliminary analyses

Descriptive statistics of attention biases (enhanced engagement and delayed disengagement), interpretation bias, social anxiety, self-esteem, and loneliness

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<sup>4</sup>All analyses described in the results section included the difference score of interpretation bias (the total score of the positive minus the total score of the negative interpretations). We also re-ran all analyses with the raw negative interpretations scores instead. These results were almost similar as the analyses with the interpretation difference scores (with the exception of negative interpretations in grade 7 being no longer a significant predictor of social anxiety in grade 8). The findings of these exploratory analyses can be found in Table C, Part D, and Figure E of the Appendices.



in grades 7, 8, and 9 are shown in Table 1<sup>5</sup>. The mean social anxiety level in the sample was relatively low, with only 10.8% to 14.7% of individuals across grades experiencing clinical levels of social anxiety (scores of 50 or higher as described by la Greca & Lopez, 1998)<sup>6</sup>. On average, adolescents tended to engage faster to positive than negative stimuli (represented by the positive mean scores in all grades) but experienced difficulty disengaging from threat (represented by the negative mean scores in all grades). Moreover, as seen by the positive mean scores for interpretation bias, adolescents were, in general, more likely to interpret social situations positively. However, the relatively high standard deviations indicated that individual differences in attention biases and interpretation bias were large.

Pearson's correlation analyses between all variables at all three grades were conducted to see how the variables related to each other throughout adolescence (see Table 2). Attention bias engagement levels only correlated weakly between grades 7 and 9 but were not linked in the other grades. A weak correlation was found between attention bias disengagement in grades 7 and 8, and in grades 8 and 9 but levels in grades 7 and 9 did not correlate significantly. Interpretation bias, social anxiety, self-esteem, and loneliness were moderate to highly stable across grades.

The different attention bias components correlated negatively but weakly with each other within and across all grades, with the exception of the link between engagement in grade 7 and disengagement in grade 9 for which the correlation was positive. Different than expected, in general, higher enhanced engagement to threat was thus related to less difficulty with disengaging from threat. Attention bias engagement and disengagement were not related to interpretation bias, social anxiety, self-esteem, or loneliness within or across any of the grades with two exceptions: (1) more difficulty with disengaging from threat in grade 8 was related to a higher positive interpretation bias in grade 9; and (2) a higher positive interpretation bias in grade 7 was related to more difficulty with disengaging from threat in grade 9. These directions were different than what was expected but both of these correlations were weak.

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<sup>5</sup> Table B in the Appendices also presents the descriptive statistics of the raw positive, negative and neutral interpretation scores.

<sup>6</sup> When using a cut-off of 44 or higher as described by Olivares et al. (2002), 20.1% to 25.8% of individuals across grades experienced clinical levels of social anxiety.

Social anxiety, interpretation bias, self-esteem, and loneliness significantly correlated within and across waves with each other, but the strengths of the correlations varied from weak to strong. Higher levels of social anxiety were related to higher negative interpretation bias and loneliness, and lower self-esteem. Higher negative interpretation bias was linked to higher loneliness and lower self-esteem. Finally, higher loneliness was related to lower self-esteem.

**Table 1**

*Means and standard deviations of attention bias, interpretation bias, social anxiety, self-esteem, and loneliness per grade*

|                     | Grade 7  |          |           | Grade 8  |          |           | Grade 9  |          |           |
|---------------------|----------|----------|-----------|----------|----------|-----------|----------|----------|-----------|
|                     | <i>N</i> | <i>M</i> | <i>SD</i> | <i>N</i> | <i>M</i> | <i>SD</i> | <i>N</i> | <i>M</i> | <i>SD</i> |
| AB engagement       | 519      | 938.26   | 1119.31   | 568      | 847.18   | 1181.68   | 355      | 875.99   | 975.75    |
| AB disengagement    | 519      | -1286.61 | 1257.70   | 568      | -1233.52 | 1191.47   | 355      | -1182.29 | 1029.15   |
| Interpretation bias | 552      | 5.49     | 9.07      | 611      | 5.41     | 9.21      | 368      | 5.25     | 8.65      |
| Social anxiety      | 552      | 35.23    | 10.79     | 610      | 35.21    | 11.06     | 368      | 36.57    | 10.94     |
| Self-esteem         | 552      | 32.09    | 4.58      | 610      | 32.16    | 4.96      | 368      | 31.95    | 5.16      |
| Loneliness          | 551      | 16.66    | 5.17      | 610      | 16.49    | 5.28      | 368      | 16.65    | 5.11      |

*Note.* AB = attention bias. Sample size differs per variable and per grade due to missing data.

**Table 2**

*Pearson's correlations between attention bias, interpretation bias, social anxiety, self-esteem, and loneliness for grade 7, grade 8, grade 9 (white), and across waves (grey) including autocorrelations (black)*

|                | Grade 7 |       |      |       |       |       | Grade 8 |       |       |       |       |       | Grade 9 |       |       |       |       |       |
|----------------|---------|-------|------|-------|-------|-------|---------|-------|-------|-------|-------|-------|---------|-------|-------|-------|-------|-------|
|                | 1.      | 2.    | 3.   | 4.    | 5.    | 6.    | 1.      | 2.    | 3.    | 4.    | 5.    | 6.    | 1.      | 2.    | 3.    | 4.    | 5.    | 6.    |
| Grade 7        |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       |       |       |       |
| 1. AB eng.     | --      | -.23* | .00  | -.06  | .02   | -.07  | .05     | -.12* | -.00  | .02   | .07   | .05   | .20*    | -.00  | -.06  | .03   | -.02  |       |
| 2. AB diseng.  |         | --    | -.08 | -.01  | -.08  | .01   | -.20*   | .14*  | -.00  | -.04  | -.04  | .02   | -.20*   | .11   | .02   | .15   | .02   | .16   |
| 3. Int. bias   |         |       | --   | -.45* | .44*  | -.41* | -.01    | -.03  | .60*  | -.35* | .27*  | -.24* | -.03    | -.17* | .63*  | -.28* | .21*  | -.22* |
| 4. Social anx. |         |       |      | --    | -.54* | .73*  | -.04    | .03   | -.38* | .65*  | -.40* | .54*  | -.09    | .10   | -.39* | .48*  | -.31* | .37*  |
| 5. Self-esteem |         |       |      |       | --    | -.51* | .02     | -.05  | .37*  | -.53* | .66*  | -.44* | -.04    | -.15  | .33*  | -.37* | .55*  | -.30* |
| 6. Loneliness  |         |       |      |       |       | --    | -.07    | .03   | -.35* | .51*  | -.35* | .63*  | .03     | .12   | -.32* | .42*  | -.30* | .43*  |
| Grade 8        |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       |       |       |       |
| 1. AB eng.     |         |       |      |       |       |       | --      | -.23* | .01   | -.02  | .06   | -.00  | .11     | -.11* | .06   | -.04  | .04   | .00   |
| 2. AB diseng.  |         |       |      |       |       |       |         | --    | -.05  | .02   | -.02  | .03   | -.15*   | .24*  | -.13* | .07   | -.04  | .05   |
| 3. Int. bias   |         |       |      |       |       |       |         |       | --    | -.48* | .41*  | -.41* | .02     | -.03  | .63*  | -.41* | .33*  | -.27* |
| 4. Social anx. |         |       |      |       |       |       |         |       |       | --    | -.56* | .69*  | -.03    | -.00  | -.44* | .69*  | -.45* | .45*  |
| 5. Self-esteem |         |       |      |       |       |       |         |       |       |       | --    | -.49* | .02     | .04   | .38*  | -.48* | .70*  | -.35* |
| 6. Loneliness  |         |       |      |       |       |       |         |       |       |       |       | --    | -.05    | .02   | -.36* | .60*  | -.41* | .59*  |
| Grade 9        |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       |       |       |       |
| 1. AB eng.     |         |       |      |       |       |       |         |       |       |       |       |       | --      | -.20* | .05   | -.01  | -.02  | -.03  |
| 2. AB diseng.  |         |       |      |       |       |       |         |       |       |       |       |       |         | --    | -.06  | -.04  | -.07  | -.10  |
| 3. Int. bias   |         |       |      |       |       |       |         |       |       |       |       |       |         |       | --    | -.50* | .45*  | -.40* |
| 4. Social anx. |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       | --    | -.57* | .71*  |
| 5. Self-esteem |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       |       | --    | -.46* |
| 6. Loneliness  |         |       |      |       |       |       |         |       |       |       |       |       |         |       |       |       |       | --    |

*Note.* AB eng. = attention bias engagement; AB diseng. = attention bias disengagement; Int. bias = interpretation bias; Social anx. = social anxiety. Sample size differs per correlation due to missing data. \* Significant correlation,  $p < .05$ .  $r = .10$  was considered as a weak,  $r = .30$  as a moderate, and  $r = .50$  as a strong effect (Cohen, 1988).

## Main longitudinal analyses

### *Model construction*

There were no major violations of the assumptions for linear regression analyses (see pre-registration for more information). We computed cross-lagged panel models in Mplus version 8.6 (Muthén & Muthén, 2017). Three models were tested to investigate the direct effects of attention biases (enhanced engagement and delayed disengagement), and interpretation bias on social anxiety (Model 1), the link between attention biases and interpretation bias over time (Model 2), and the interaction effect of attention biases and interpretation bias on social anxiety (Model 3). In all models, autoregressive paths of attention biases, interpretation bias, and social anxiety from grades 7 to 8, and from grades 8 to 9 were modelled to control for the stability of the variables. Within-grade correlations between all variables in each grade were modelled. In all models, self-esteem and loneliness were added as covariates (i.e., autoregressive paths of the covariates and within-grade correlations between the covariates and all other variables in all grades were modelled). Model 1 included the direct effects of attention biases (enhanced engagement and delayed disengagement) and interpretation bias in grade 7 to social anxiety in grade 8, and from biases in grade 8 to social anxiety in grade 9. Model 2 included in addition the cross-lagged paths between attention biases and interpretation bias. Model 3 included the same paths as Model 2 but also included the interaction terms between attention biases and interpretation bias to social anxiety. We computed interaction terms of the standardized bias difference scores of attention bias and interpretation bias by multiplying them with each other. We did this separately for attention bias enhanced engagement and delayed disengagement.

Good model fit was concluded if the chi-square test was non-significant,  $p > .05$ , CFI  $> 0.95$ , RMSEA  $< 0.06$ , and SRMR  $< 0.08$  (Hu & Bentler, 1999). As the chi-square test is very sensitive to sample size, the main conclusions about the model fit were drawn from the other fit criteria. Lower Akaike Information Criterion (AIC) values indicated a better fit. Changes in fit between the three models were examined using a chi-square difference test and evaluated as substantial if  $\Delta\text{CFI} \geq -0.010$ ,  $\Delta\text{RMSEA} \geq 0.015$ , and  $\Delta\text{SRMR} \geq 0.010$  (Chen, 2007).

### *Direct effects of attention biases and interpretation bias on social anxiety*

Model 1 had an appropriate model fit according to most fit indices except the chi-square,  $\chi^2(90) = 221.98$ ,  $p < .001$ , CFI = 0.95, RMSEA = 0.04, SRMR = 0.08, AIC

= 22382.03. Autoregressive effects for social anxiety, interpretation bias, self-esteem, and loneliness indicated moderate to high stability across grades (ranging between  $\beta = .48-.64$ ). Attention bias disengagement was weakly to moderately stable over time ( $\beta = .12-.22$ ), while autoregressive effects for attention bias engagement were all non-significant.

Interpretation bias in grade 7 negatively predicted the level of social anxiety symptoms in grade 8 ( $\beta = -.08$ ). This effect was only weak but indicated that adolescents with a higher negative interpretation bias experienced increased social anxiety one year later. However, this effect was not found from interpretation bias in grade 8 to social anxiety in grade 9 ( $\beta = -.06, p = .08$ ). None of the attention bias parameters predicted social anxiety over time. Within-grade correlations are not interpreted, for that we would like to refer to the findings of the Pearson correlations.

### ***Associations between attention biases and interpretation bias***

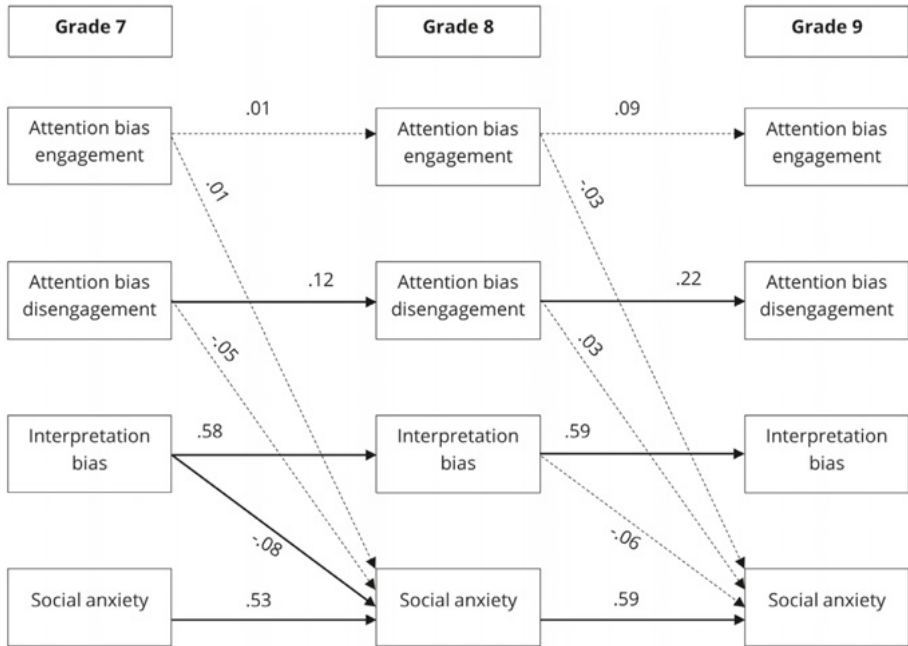
Model 2 encompassing the direct effects between different biases had a comparable fit to Model 1,  $\chi^2(82) = 217.16, p < .001, CFI = 0.95, RMSEA = 0.05, SRMR = 0.08, AIC = 22393.21$ . Including the direct effects between attention biases and interpretation bias did not lead to a significant or substantial improvement in model fit compared to Model 1,  $\Delta\chi^2(8) = 4.82, p = .777, \Delta CFI = 0.001, \Delta RMSEA = -0.003, \Delta SRMR = 0.001, \text{ and } \Delta AIC = 11.19$ . Attention bias engagement and disengagement did not predict interpretation bias levels, nor did interpretation bias predict attention biases over time.

### ***Interaction effect attention biases and interpretation bias in social anxiety***

When adding the interaction terms between attention biases and interpretation bias in Model 3, the model fit remained comparable to the first and second model,  $\chi^2(126) = 309.79, p < .001, CFI = 0.93, RMSEA = 0.04, SRMR = 0.07, \text{ and } AIC = 28805.56$ . The model fit was significantly and substantially (according to CFI) worse than Model 1 ( $\Delta\chi^2(36) = 87.81, p < .001, \Delta CFI = -0.019, \Delta RMSEA = 0.000, \Delta SRMR = -0.009, \text{ and } \Delta AIC = 6423.53$ ) and Model 2 ( $\Delta\chi^2(44) = 92.62, p < .001, \Delta CFI = -0.018, \Delta RMSEA = -0.003, \Delta SRMR = -0.008, \text{ and } \Delta AIC = 6412.345$ ). All four interaction effects were non-significant, indicating that attention biases and interpretation bias did not mutually predict social anxiety over time.

To summarize, Models 2 and 3 did not significantly improve the model fit, nor were these paths significant. Therefore, Model 1 functioned as our final model (see Figure 2).

**Figure 2**  
Graphic representation of Model 1 (final model) with its standardized regression estimates (beta coefficients)



Note. Dashed paths represent non-significant paths; solid paths represent significant paths,  $p < .05$ .  $\beta < .20$  was considered as weak,  $\beta = .20-.50$  as moderate, and  $\beta > .50$  as strong effects (Acock, 2014). For clarity of presentation, concurrent correlations between the variables, and the covariate paths with self-esteem and loneliness are not presented in this figure.

## **DISCUSSION**

In this study, we investigated how negative attention biases (enhanced engagement to threat and delayed disengagement from threat) and negative interpretation bias were related to social anxiety during three years of adolescence. Additionally, we investigated whether attention biases and interpretation bias were related to each other, and individually and/or mutually predicted social anxiety as assumed by the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006). In this prospective longitudinal study, we found support for the role of negative interpretation bias in social anxiety during adolescence. However, neither one of the attention bias types was able to predict social anxiety. Moreover, no evidence was found for the CCBH, as attention biases and interpretation bias were not related and did not interact with each other concerning social anxiety.

### **Individual effects of attention biases and interpretation bias on social anxiety**

Attention biases (i.e., enhanced engagement to threat and delayed disengagement from threat) were not related to social anxiety, thereby adding to the current field of research showing mixed and inconclusive evidence for the role of attention bias in social anxiety in youth (Morren et al., 2004; Puliafico & Kendall, 2006; Roy et al., 2008; Waters et al., 2011). Interpretation bias, on the other hand, did negatively relate to social anxiety, with higher negative interpretation bias predicting an increase in social anxiety. This finding was in line with cognitive models (e.g., Beck et al., 2005; Wong & Rapee, 2016) and previous research on children and adolescents (Stuijzand et al., 2018). The effect of interpretation bias was only present from grade 7 to grade 8, which was contrary to the suggestion that the link between interpretation bias and social anxiety increased with age (Stuijzand et al., 2018). The absence of an effect from grade 8 to grade 9 could be explained by the fact that adolescents stayed in the same class in grades 7 and 8 but switched classes in grade 9. Entering a new peer context involves establishing new friendships and social ties, and it calls for a new social ranking of the peer group. A new peer context could elevate social fears (as adolescents have to meet new peers which could be threatening) but could also bring positive opportunities to adolescents (e.g., if adolescents are bullied in their previous context, they could form more positive peer relationships in the new context). These social contextual changes

may have complicated our findings as it is unsure how the new peer context impacts the relationship between interpretation bias and social anxiety.

The different effects of attention bias versus interpretation bias in relation to social anxiety may also have something to do with the different conceptualization of attention and interpretation biases, and the developmental time frame under investigation. While interpretation bias is found to be a stable trait-like characteristic (Creswell & O'Connor, 2011), researchers argue that attention biases are fluctuating over time (which was also confirmed by our results), being highly context-dependent, and could be better understood as state processes (Zvielli et al., 2015). Indeed, a previous study showed that stressful situations may alter attention biases (Bar-Haim et al., 2010), and in fact, attention biases for threat were already unstable across 7 days (Li et al., 2008). Perhaps, the yearly time interval of the current study was thus too large to find effects of attention biases related to social anxiety. Future research could benefit from measurement burst designs with multiple measurement moments with short time intervals (Sliwinski, 2008).

In our study, we used an unselected community sample. As expected, the percentage of individuals with clinically social anxiety levels was rather small, ranging between 10.8% and 14.7% across grades (scores of 50 or higher as described by la Greca & Lopez, 1998). Re-examining the descriptive statistics for this subsample of clinically anxious adolescents showed that this subgroup tended to negatively interpret situations compared to non-anxious adolescents who showed a positive interpretation bias. However, the attention bias patterns were similar for the entire normative sample compared to the socially anxious subgroup. This suggests that maybe a negative attention bias does not exist for these individuals at all, or that the sample size of this subgroup was too small to find a negative attention bias. To conclude, our results suggest that attention bias does not play an important role in explaining individual differences in social anxiety in a normative sample of adolescents, while interpretation bias did. Replicating this study with a large (sub-)clinical sample of socially anxious adolescents could help to investigate the generalization of findings from analogue samples such as in our study (Chen et al., 2020), and formally test whether the Combined Cognitive Bias Hypothesis does apply differently to individuals with heightened social fears.

The lack of findings with regards to attention bias in social anxiety could be because of certain other methodological factors. For instance, there is much



doubt regarding the adequacy of the psychometric properties of reaction-time-based paradigms for measuring attention bias in children (e.g., Brown et al., 2014; Wermes et al., 2017). In contrast, some studies provided evidence that the visual search task was successful for detecting attentional threat biases in youth and better in doing so than other measures of attention bias such as the dot-probe task (de Voogd et al., 2016). Not only the visual search task in itself raises questions but there is also some discussion about the type of stimuli used in this task. Some argue that especially angry facial expressions may be ecologically valid threat stimuli for adolescents with social anxiety, as it reflects the fear of rejection (Rinck & Becker, 2005). However, others suggested that it would also be interesting to investigate attention to different negative emotional expressions, such as disgust, as that may convey the desire to avoid or reject (Buckner et al., 2010). Future research should formally test the reliability and validity of the task and stimuli.

In our study, the visual search task seemed to be unreliable, seen by the high standard deviations and the weak or non-significant correlations between the attention bias variables across and within grades. This unreliability could be due to two competing explanations. On the one hand, participants could have become fatigued during the attention bias task and may have not responded to the later trials in a concentrated manner. This explanation seems plausible as several adolescents complained that the task was long and repetitive and that they were easily distracted. However, our results showed that there was no difference between data from the first and the second half of the task (in fact, scores between blocks 1 and 2 were moderately correlated), and previous studies with adolescents even successfully included more trials (72 compared to 48 trials in our study; de Voogd et al., 2017). On the other hand, we may have not included enough trials in our task, since a higher amount of trials increases the stability of effects. When developing a task there is an important trade-off between the number of trials necessary to find stable effects and the feasibility of the task for participants (Price et al., 2015). Because our data collection procedure consisted of many measures, we decided to keep the attention bias task relatively short. Future research should determine the minimum amount of trials necessary to retrieve reliable attention bias data.

Another methodological explanation comes from the suggestion that attention bias consists of many different subcomponents that unfold from moment to

moment across time (Rodebaugh et al., 2016; Zvielli et al., 2015). A previous study only found a negative attention bias in anxious individuals during the first 500 milliseconds of stimulus presentation (Gamble & Rapee, 2009). Our visual search task, in which participants were allowed to view the stimuli as long as they needed, did not allow for determining the time course of various attention bias processes. Future studies including for instance eye-tracking would be better able to determine the time frame in which these processes should occur (Armstrong & Olatunji, 2012; Roy et al., 2015), and eye-tracking was found to be a successful method for children and adolescents (In-Albon & Schneider, 2010).

Finally, the difference in the results of attention bias and interpretation bias could also be accounted for by the difference in self-relevance between both tasks. The interpretation bias task specifically instructs participants to imagine themselves being in the situation. However, the attention bias task did not induce any form of self-relevance with the task but simply asked to detect a face. Previous findings show that negative biases are mostly triggered when faced with stress or in self-relevant situations (Vassilopoulos & Banerjee, 2012). Future research could thus examine whether different attention bias results would be found if a stress induction is used or if the self-relevance with the attention bias task is increased.

### **Combined Cognitive Bias Hypothesis**

Finally, attention biases were not related to interpretation bias, neither directly nor in interaction when predicting social anxiety, showing no support for the Combined Cognitive Bias Hypothesis for social anxiety in adolescents (Hirsch et al., 2006). This is contrary to two previous studies showing a link between attention and interpretation biases in youth anxiety, including social anxiety (Rozenman et al., 2014; Watts & Weems, 2006), and research showing the effectiveness of combined Cognitive Bias Modification (CBM) techniques in reducing social anxiety (Beard et al., 2011; Lisk et al., 2018). There are two possible interpretations of these findings. On the one hand, it could be that there is simply no support for the CCBH in adolescence. Attention bias and interpretation bias may just not be related, and rather function as two independent processes. This suggestion could theoretically be supported by neurological models arguing that automatic (i.e., attention bias) and more effortful controlled (i.e., interpretation bias) regulatory processing are managed in a partly different way by the brain (Cunningham et al.,

2004). In line with this reasoning, it would then be important to study attention bias and interpretation bias as separate processes to understand the development of social anxiety.

On the other hand, it could also be that the different biases were not related to each other because of the methodological difficulties with measuring attention bias in particular (as extensively discussed earlier). In addition, the result that different cognitive biases were not related to each other, could also be attributed to another methodological issue, namely the different modalities used for the attention bias and interpretation bias task. Specifically, in our study, interpretation bias was measured with verbal vignettes, while attention bias was assessed using pictures of emotional faces. The use of visual versus verbal stimuli may have complicated the possibility to find a relationship between these different cognitive biases, particularly because the degree of social fears was also assessed with a verbal measure. Future research should develop comparable cognitive bias tasks to assess both attention bias as well as interpretation bias, ideally in the same modality. An attempt for this has already been made, with two studies integrating attention bias paradigms in a standard verbal interpretation task. Specifically, participants completed a scrambled sentence task to see whether they would complete the sentence positively or negatively (as an indication of interpretation bias) and tracked the time spent on the positive versus negative words (as an indication of attention bias) (Sanchez et al., 2015; Sanchez-Lopez et al., 2019). Another study also showed the utility of a pictorial task to assess interpretation bias, to ensure that the modality of the task is similar to that of classical attention bias tasks in which visual stimuli are also often used (Henricks et al., 2022). Equalizing the assessment of attention bias and interpretation bias in terms of modality also led to stronger associations between the two biases, with Pearson correlations ranging between  $r = .30$  and  $r = .32$ ,  $p < .05$  (Sanchez et al., 2015), as compared to the non-significant correlations found in the present study.

### **Strengths, limitations, and future research**

This pre-registered, prospective longitudinal study was one of the first to investigate the link between different cognitive biases across three years of adolescence. Including multiple measurement moments across different years allowed for the longitudinal investigation of these cognitive processes during a period that is

critical for social cognitive development (Choudhury et al., 2006) and the rise of psychopathology, including social anxiety (Mesa et al., 2011). Another strength of the study was its relatively large sample size, allowing for well-powered statistical analyses (i.e., in the most complex model we had at least 10 observations per parameter; Kline, 2015).

However, there were also some limitations to this study. As discussed extensively earlier, the reliability of the attention bias task needs further improvement. In addition, we investigated two components of attention bias: enhanced engagement to threat (in other studies referred to as early vigilance to threat) and delayed disengagement from threat, which is in line with recent attention bias frameworks (Richards et al., 2014). However, other theories suggest that after detecting a threat, socially anxious individuals are characterized by the quick visual avoidance of the threat (e.g., the hypervigilance-avoidance model; Mogg & Bradley, 1998). It might be that this attentional avoidance is the key process in attention bias and accounts for the maintenance of social fears because it prevents the exposure, and therefore the habituation and objective evaluation of socially threatening information (Amir & Bomyea, 2010; Mogg et al., 1997). Unfortunately, the visual search task used did not allow for this avoidance process to be captured. Future research needs to focus on all three attention bias mechanisms to fully understand attention bias as a whole, for instance by using eye-tracking (Cisler & Koster, 2010). Third, in our study, we focused specifically on adolescence as this is the age period in which stable social cognitions emerge (Lakdawalla et al., 2007). However, there are also studies supporting the existence of attention biases related to depression in 5-years old children (Kujawa et al., 2011). As recommended by Platt et al. (2017) future studies should concentrate on investigating cognitive biases across a wide developmental period to better understand the emergence of cognitive biases and their role in the onset and maintenance of psychopathology. Fourth and finally, another important suggestion for future research would be to examine individual differences in our conceptual model. Due to the heterogeneity among socially anxious individuals (Binelli et al., 2015), it could be that the Combined Cognitive Bias Hypothesis only applies to a specific subsample. For instance, concepts such as self-esteem or social competence could play a moderating role, as they are found to be related to cognitive biases and social anxiety (Miers et al., 2013; Tran et al., 2011; van Tuijl et al., 2014). Other statistical analyses such as Latent Class Growth Modeling and network analyses could be more beneficial to investigate individual differences than the cross-lagged panel models used in the current study.

## **Conclusion**

The current study showed that negative interpretation bias predicted higher levels of social anxiety one year later. Attention bias did not predict social anxiety. No support was found for the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006). Attention bias and interpretation bias were not longitudinally related to each other, nor did they interact with each other in predicting social anxiety. Taking the limitations into account, our results indicate that interpretation bias rather than attention biases contribute to the increase of social anxiety over time. Future research should, apart from improving attention bias tasks for adolescents, continue to focus on the role of different cognitive processes, and how they relate and interact with each other when predicting social anxiety. This is needed to provide conclusive evidence of whether or not the Combined Cognitive Bias Hypothesis does apply to adolescents and may set important guidelines for current treatments. For instance, if our results are replicated and only interpretation bias is found to play a role in social anxiety, clinical practice should focus more on Cognitive Bias Modification techniques for interpretation (CBM-I) than on attention bias (CBM-A) or combined CBM.

## **ACKNOWLEDGEMENTS**

We are grateful to the parents, teachers, and school administrators who made this research possible. Also thanks to all the research assistants who helped with the data collection. Special thanks to Giovanni ten Brink for his help with programming and processing of the data.

## APPENDICES

**Table A**

*Distribution of final sample across cohorts (N = 816)*

| Cohort | N   | Year    |         |         |
|--------|-----|---------|---------|---------|
|        |     | 2017    | 2018    | 2019    |
| 1      | 259 | Grade 7 | Grade 8 | Grade 9 |
| 2      | 242 | Grade 8 | Grade 9 | -       |
| 3      | 176 | -       | Grade 7 | Grade 8 |
| 4      | 139 | -       | -       | Grade 7 |
| Total  | 816 |         |         |         |

*Note.* The total sample consisted of participants who were at least present during one grade, and for participants who duplicated a grade, the data from the duplicate grade onwards was removed.

**Table B**

*Means and standard deviations of positive, negative, and neutral interpretation scores per grade*

|                          | Grade 7 |       |      | Grade 8 |       |      | Grade 9 |       |      |
|--------------------------|---------|-------|------|---------|-------|------|---------|-------|------|
|                          | N       | M     | SD   | N       | M     | SD   | N       | M     | SD   |
| Positive interpretations | 552     | 26.12 | 4.93 | 611     | 26.20 | 5.36 | 368     | 26.53 | 4.81 |
| Negative interpretations | 552     | 20.63 | 5.49 | 611     | 20.79 | 5.64 | 368     | 21.28 | 5.33 |
| Neutral interpretations  | 552     | 26.67 | 4.54 | 611     | 27.28 | 4.66 | 368     | 28.27 | 4.15 |

**Table C**  
*Pearson's correlations between attention bias, negative interpretations, social anxiety, self-esteem, and loneliness for grade 7, grade 8, grade 9 (white), and across waves (grey) including autocorrelations (black)*

|                | Grade 7 |       |      |      |       |       | Grade 8 |       |       |       |       |       | Grade 9 |       |       |       |       |       |       |
|----------------|---------|-------|------|------|-------|-------|---------|-------|-------|-------|-------|-------|---------|-------|-------|-------|-------|-------|-------|
|                | 1.      | 2.    | 3.   | 4.   | 5.    | 6.    | 1.      | 2.    | 3.    | 4.    | 5.    | 6.    | 1.      | 2.    | 3.    | 4.    | 5.    | 6.    |       |
| <b>Grade 7</b> |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       |       |       |       |
| 1. AB eng.     | --      | -.23* | -.01 | -.06 | .02   | -.07  | .05     | -.12* | .03   | .02   | .07   | .05   | .20*    | .05   | -.06  | .03   | -.02  |       |       |
| 2. AB diseng.  |         |       | .06  | -.01 | -.08  | .01   | -.20*   | .14*  | .01   | -.04  | -.04  | .02   | .11     | .03   | .15   | .02   | .16   |       |       |
| 3. Int. neg.   |         |       | --   | .47* | -.40* | .39*  | .04     | .01   | .53*  | .34*  | -.27* | .24*  | .19*    | .50*  | .25*  | -.19* | .21*  |       |       |
| 4. Social anx. |         |       |      | --   | -.54* | .73*  | -.04    | .03   | .31*  | .65*  | -.40* | .54*  | .10     | .40*  | .48*  | -.31* | .37*  |       |       |
| 5. Self-esteem |         |       |      |      | --    | -.51* | .02     | -.05  | -.31* | -.53* | .66*  | -.44* | -.15    | -.24* | -.37* | .55*  | -.30* |       |       |
| 6. Loneliness  |         |       |      |      |       | --    | -.07    | .03   | .27*  | .51*  | -.35* | .63*  | .03     | .12   | .31*  | .42*  | -.30* | .43*  |       |
| <b>Grade 8</b> |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       |       |       |       |
| 1. AB eng.     |         |       |      |      |       |       | --      | -.23* | .00   | -.02  | .06   | -.00  | .11     | -.11* | -.04  | -.04  | .04   | .00   |       |
| 2. AB diseng.  |         |       |      |      |       |       |         |       | .03   | .02   | -.02  | .03   | -.15*   | .24*  | .14*  | .07   | -.04  | .05   |       |
| 3. Int. neg.   |         |       |      |      |       |       |         |       | --    | .49*  | -.35* | .39*  | -.01    | .03   | .55*  | .38*  | -.31* | .22*  |       |
| 4. Social anx. |         |       |      |      |       |       |         |       |       | --    | -.56* | .69*  | -.03    | -.00  | .42*  | .69*  | -.45* | .45*  |       |
| 5. Self-esteem |         |       |      |      |       |       |         |       |       |       | --    | -.49* | .02     | .04   | -.31* | -.48* | .70*  | -.35* |       |
| 6. Loneliness  |         |       |      |      |       |       |         |       |       |       |       | --    | -.05    | .02   | .32*  | .60*  | -.41* | .59*  |       |
| <b>Grade 9</b> |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       |       |       |       |
| 1. AB eng.     |         |       |      |      |       |       |         |       |       |       |       |       |         | --    | -.20* | -.07  | -.01  | -.02  | -.03  |
| 2. AB diseng.  |         |       |      |      |       |       |         |       |       |       |       |       |         |       | --    | .08   | -.04  | -.07  | -.10  |
| 3. Int. neg.   |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       | --    | .45*  | -.40* | .33*  |
| 4. Social anx. |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       | --    | -.57* | .71*  |
| 5. Self-esteem |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       |       | --    | -.46* |
| 6. Loneliness  |         |       |      |      |       |       |         |       |       |       |       |       |         |       |       |       |       |       | --    |

*Note.* AB eng. = attention bias engagement; AB diseng. = attention bias disengagement; Int. neg. = negative interpretations; Social anx. = social anxiety. Sample size differs per correlation due to missing data. \* Significant correlation,  $p < .05$ .  $r = .10$  was considered as a weak,  $r = .30$  as a moderate, and  $r = .50$  as a strong effect (Cohen, 1988).

## Part D Exploratory longitudinal analyses

We also explored whether the results of the longitudinal model were similar if the negative interpretation scores were included in the model, instead of the interpretation bias difference scores. Using this alternative interpretation construct did not affect the assumptions for linear regression analyses, there were still no major violations. The model construction was similar to our main analyses described in the results section of the manuscript. The same three models were tested with this alternative score of interpretation. The interaction terms in Model 3 were computed based upon the standardized bias difference scores of attention bias and the standardized negative interpretation scores by multiplying them with each other. We did this separately for attention bias enhanced engagement and delayed disengagement. The same fit criteria were used as in the original analyses to evaluate (the change in) model fit.

### ***Direct effects of attention biases and interpretation bias on social anxiety***

Model 1 had an appropriate model fit according to most fit indices except the chi-square,  $\chi^2(90) = 212.68, p < .001$ , CFI = 0.95, RMSEA = 0.04, SRMR = 0.08, AIC = 22494.58. Autoregressive effects for social anxiety, interpretation bias, self-esteem, and loneliness indicated moderate to high stability across grades (ranging between  $\beta = .50-.66$ ). Attention bias disengagement was weakly to moderately stable over time ( $\beta = .12-.21$ ), while autoregressive effects for attention bias engagement were all non-significant.

Different than in our original analyses, interpretation bias in grade 7 did not negatively predict the level of social anxiety symptoms in grade 8 ( $\beta = .06, p = .08$ ). Also, this effect was not found from interpretation bias in grade 8 to social anxiety in grade 9 ( $\beta = .04, p = .32$ ). None of the attention bias parameters predicted social anxiety over time. Within-grade correlations are not interpreted, for that we would like to refer to the findings of the Pearson correlations.

### ***Associations between attention biases and interpretation bias***

Model 2 encompassing the direct effects between different biases had a comparable fit to Model 1,  $\chi^2(82) = 209.04, p < .001$ , CFI = 0.95, RMSEA = 0.04, SRMR = 0.08, AIC = 22506.94. Including the direct effects between attention biases and interpretation bias did not lead to a significant or substantial improvement in model fit compared to Model 1,  $\Delta\chi^2(8) = 3.64, p = .889$ ,  $\Delta\text{CFI} = 0.002$ ,  $\Delta\text{RMSEA} = -0.003$ ,  $\Delta\text{SRMR} = 0.001$ , and  $\Delta\text{AIC} = 12.35$ . Attention bias engagement and disengagement did not predict interpretation bias levels, nor did interpretation bias predict attention biases over time.



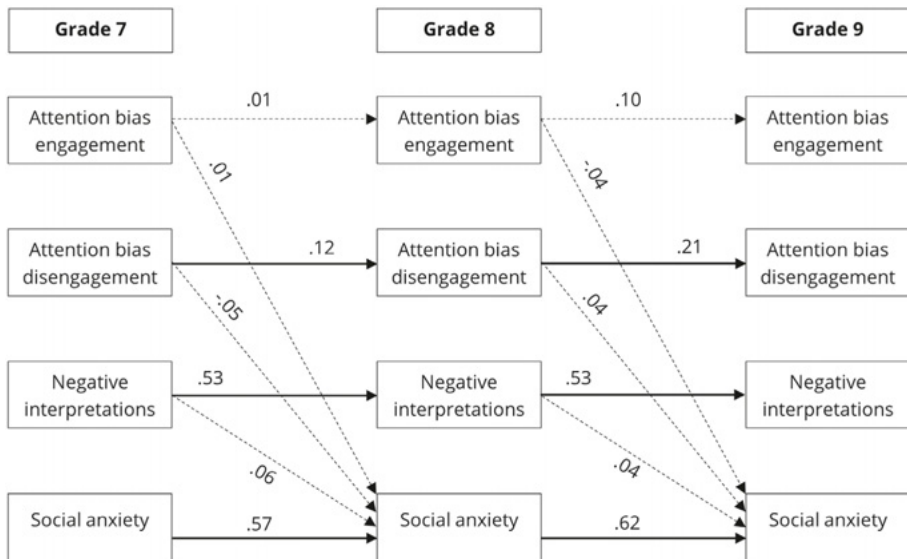
### ***Interaction effect attention biases and interpretation bias in social anxiety***

When adding the interaction terms between attention biases and negative interpretations in Model 3, the model fit remained comparable to the first and second model,  $\chi^2(126) = 285.56$ ,  $p < .001$ , CFI = 0.94, RMSEA = 0.04, SRMR = 0.07, and AIC = 28969.61. The model fit was significantly and substantially (according to CFI) worse than Model 1 ( $\Delta\chi^2(36) = 72.88$ ,  $p < .001$ ,  $\Delta\text{CFI} = -0.014$ ,  $\Delta\text{RMSEA} = -0.002$ ,  $\Delta\text{SRMR} = -0.010$ , and  $\Delta\text{AIC} = 6475.03$ ) and Model 2 ( $\Delta\chi^2(44) = 76.52$ ,  $p = .002$ ,  $\Delta\text{CFI} = -0.012$ ,  $\Delta\text{RMSEA} = -0.005$ ,  $\Delta\text{SRMR} = -0.009$ , and  $\Delta\text{AIC} = 6462.676$ ). All four interaction effects were non-significant, indicating that attention biases and interpretation bias did not mutually predict social anxiety over time.

To summarize, Models 2 and 3 did not significantly improve the model fit, nor were these paths significant. Therefore, Model 1 functioned as our final model (see Figure E).

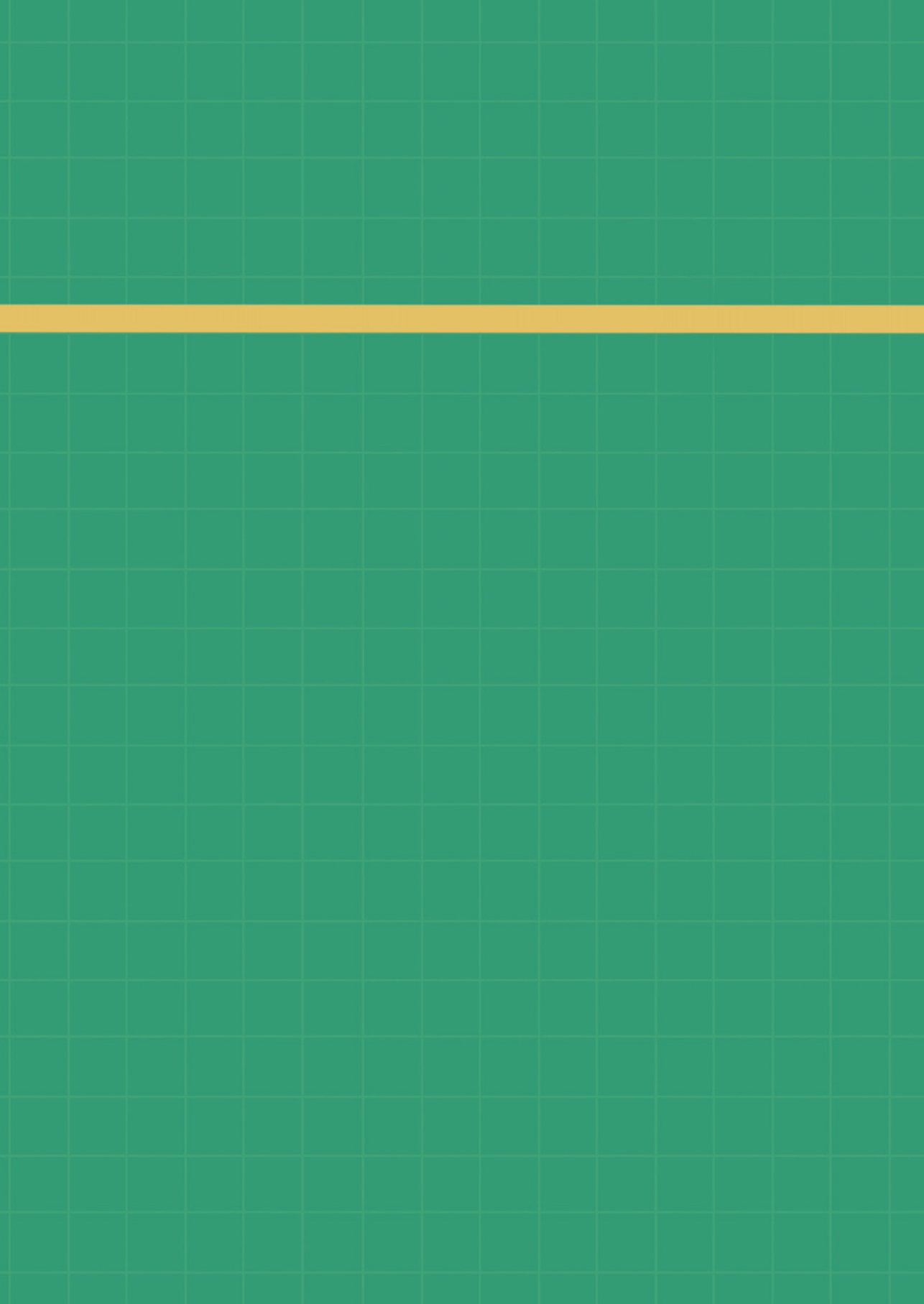
**Figure E**

*Graphic representation of Model 1 (final model including negative interpretations) with its standardized regression estimates (beta coefficients)*



*Note.* Dashed paths represent non-significant paths; solid paths represent significant paths,  $p < .05$ .  $\beta < .20$  was considered as weak,  $\beta = .20$ -.50 as moderate, and  $\beta > .50$  as strong effects (Acock, 2014). For clarity of presentation, concurrent correlations between the variables, and the covariate paths with self-esteem and loneliness are not presented in this figure.





# Chapter 3

## A new social picture task to assess interpretation bias related to social fears in adolescents

## **ABSTRACT**

This pre-registered study focused on developing a new social picture task to assess interpretation bias related to social fears in adolescents. Using such a pictorial task may increase ecological validity and readily trigger emotional processes compared to more traditional verbal tasks that are often used. In the picture task, ambiguous social pictures were presented, followed by a positive and negative interpretation. In this study, we examined how the new task relates to an already existing interpretation bias task and how the new pictorial task relates to social fears in adolescents. The sample consisted of 329 adolescents aged 12 to 18 years. Interpretation bias was assessed with the newly developed pictorial task and with more traditional verbal vignettes. Social fears were measured with self-report questionnaires. The results suggest that the pictorial task was able to assess interpretation bias comparable to the verbal vignettes, suggesting appropriate convergent validity. Interpretation bias assessed with the picture task was linked to higher levels of fear of negative evaluation, the core symptom of social anxiety but not to social anxiety symptoms in general. The verbal task was linked to both social fears and thus still seems the preferred method to investigate interpretation bias related to social fears in adolescents. However, we do believe that with further improvement of the pictorial task, it could be a useful addition to the research field.

**Keywords:** interpretation bias; social anxiety; fear of negative evaluation; adolescents

## INTRODUCTION

Puberty is a period in which adolescents are extremely sensitive to the opinion of others (Somerville, 2013), leading to an increase in social fears. Social fears are described as the fear of humiliation or embarrassment in social or performance situations and as being afraid to make a bad impression on others or by possible scrutiny (i.e., fear of negative evaluation [FNE]; American Psychiatric Association, 2013). FNE is seen as the core symptom of social anxiety (Turner et al., 1992). Social anxiety, however, is a broader concept, and also encompasses the experience of physical symptoms in social situations (e.g., trembling or blushing), and more behavioural symptoms such as avoidance and withdrawal from social situations (American Psychiatric Association, 2013). When left untreated, social fears often follow a chronic pattern leading to Social Anxiety Disorder (SAD). The mean age of onset of SAD is 15 years (Mancini et al., 2005) and it is one of the most common psychological disorders among adolescents (Costello et al., 2004) with a prevalence rate of 8.2-8.6% (Burststein et al., 2011; Kessler et al., 2012). SAD has detrimental consequences: school drop-out, troubled relationships with family, friends, and co-workers (Stein & Kean, 2000), other fears, depression, and substance use (American Psychiatric Association, 2013). So, it would be helpful to investigate which factors play a contributing role to get a better understanding of the development and maintenance of social fears.

Many theoretical models assume that biased cognitive processing plays an important (if not causal) role in the onset and maintenance of social fears (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). The relationship between social fears and cognitive biases could probably better be described as bidirectional, with both factors continuously influencing each other (Mathews & MacLeod, 2002; Wong & Rapee, 2016). Cognitive biases are defined as the processing of stimuli in a biased way and are thought to be caused by overactive schemas involving social threats. Different types of cognitive biases exist but interpretation bias seems to be especially important for social fears. Interpretation bias is described as the tendency to negatively interpret ambiguous social situations (Mathews & MacLeod, 2005). Empirical evidence for the link between interpretation bias and social fears in adolescence is consistently found. A meta-analysis of Stuijzand et al. (2018) included 27 studies on social anxiety and showed medium positive

associations between social anxiety and negative interpretation bias in children and adolescents ( $d = .72$ ). The associations increased in strength when youth got older, highlighting the importance to focus on early detection of interpretation bias to prevent its potentially causal role in the development of social fears. At the same time, the association between interpretation bias and social fears was stronger when the content of the ambiguous scenarios addressed social fears, making it important to use interpretation bias tasks specifically including social threatening stimuli.

### **Verbal vignette tasks and the benefits of pictorial versions**

Up until now, many different tasks to measure interpretation bias exist, with verbal vignettes being the most well-established and widely used type of task (Stuijzand et al., 2018). In these vignette tasks, ambiguous social scenarios are described, and individuals have to indicate whether they would interpret the scenario more benignly or negatively. Different answer options are possible in vignette tasks such as choosing one interpretation of an offered list (e.g., Creswell et al., 2005), rank-ordering different interpretations (e.g., Amin et al., 1998), rating each interpretation on a scale separately (e.g., Cox et al., 2016), or using an open-ended format in which participants have to write down their interpretation of the ambiguous situation (e.g., Reid et al., 2006). Some studies also used a combination of these different options (e.g., Miers et al., 2008). Regardless of which answer format is used, interpretation bias is consistently detected in individuals with social fears using such verbal vignette tasks (Stuijzand et al., 2018).

Even though these vignette tasks are well-established and able to detect interpretation bias in adolescents with social fears, we believe that replacing verbal vignettes with pictures of ambiguous social scenarios could be beneficial as it may increase the ecological validity and social salience of the task. Social situations are often complex, and the interpretation of a situation is highly dependent upon the context (Gaskell & Marslen-Wilson, 2001). Pictures may be a more naturalistic representation of these complex interactions and provide more information than a short abstract verbal description for instance via facial expressions, gestures, body postures, or situational cues (Haller et al., 2016).

A more controversial argument for the use of pictorial stimuli is the idea that adding pictures may increase self-relevance and mental imagery. For instance,

research showed that adding visual cues might be helpful to enhance imagination and trigger emotional processes, including interpretation biases (Pictet & Holmes, 2013). This can be explained by the fact that visual stimuli are faster to be processed than verbal stimuli as they have immediate access to affective systems in the brain, while verbal stimuli first have to be processed by another brain system, the so-called lexicon (de Houwer & Hermans, 1994). However, there is an ongoing debate about this issue, because it could also be that because pictures provide more details, they leave less room open for imagination. For instance, participants experienced more difficulties engaging with unfamiliar visual stimuli than with verbal stimuli (Lisk et al., 2018) and they found it harder to vividly imagine pictorial scenes (de Voogd et al., 2017).

Another advantage of this pictorial task compared to the vignette task is that it relies less heavily on the literacy skills of adolescents. The description of the ambiguous scenario is replaced by a picture. Interpretations can still be presented in a verbal form, but these sentences are relatively short and easily understandable. A picture task thus asks to a lesser extent the understanding of abstract verbal information. This can especially be helpful for younger adolescents, or for adolescents with learning difficulties such as dyslexia, a common problem as 11.6% of children without a family history of reading problems are diagnosed with dyslexia (Snowling & Melby-Lervåg, 2016).

Pictorial tasks to measure interpretation bias can also be valuable for interventions that aim to modify interpretation bias (i.e., Cognitive Bias Modification – Interpretation; CBM-I). Up until now, several attempts have been made in CBM-I, both using pictorial as well as verbal training (e.g., de Voogd et al., 2017; Lisk et al., 2018). Interestingly though, the pre-post effectiveness of the training was assessed in both studies using verbal interpretation bias tasks only. This is problematic as it required a larger transfer-effect from training to interpretation bias measure for the pictorial version than for the verbal version of the training. Indeed, in the study of de Voogd et al. (2017), it was found that the verbal CBM-I version was more effective in reducing negative interpretation bias, which could have been a side-effect of the modality of the assessment task which more closely matched the verbal training. By developing a pictorial task to assess interpretation bias, we could thus more validly investigate the effectiveness of pictorial CBM-I training.



## **Social picture tasks**

Up until now, three studies developed a social picture task to assess interpretation bias related to social fears in children and adolescents. One of these studies used a combination of verbal and visual descriptions of ambiguous scenarios for children from 5 to 9 years old (Creswell et al., 2011). Specifically, the description of the ambiguous scenarios was spoken and accompanied by a cartoon representation of the situation. Children were then presented with two cartoons explaining the situation, a threatening and a non-threatening interpretation, and had to indicate which interpretation would be most likely. Results of this study showed that children with more threat interpretations experienced more anxiety levels at the same time point. Adding these cartoons facilitates the understanding and imagination of the situations but does not improve the ecological validity of the task as cartoons are more simple and less naturalistic representations of social situations.

In another study with children and adolescents aged 7 to 13, pictures were used without any verbal descriptions (In-Albon et al., 2008). Socially ambiguous pictures were shown, and participants had to indicate as fast as possible whether the picture represented a popular or unpopular child by pressing a button. Their results showed that children with social anxiety tended to categorize children in ambiguous social pictures as unpopular and thus negatively interpreted the situation. The stimuli in this study however did not promote self-relevance: children were not instructed to imagine themselves in the ambiguous situation but just had to rate the actor in the situation. This may not be optimal since negative interpretations are especially triggered in self-relevant situations (Vassilopoulos & Banerjee, 2012).

Finally, Haller et al. (2016) developed a social picture task for adolescents between 14 to 17 years old. They created pictures of everyday situations and added an image of the back of the participant into each picture to fabricate the participant within the social scene. By doing so, the authors aimed to facilitate mental imagery and enhance self-relevance with the situation. The scenes were primarily situated in and around medieval school buildings with more classical interiors common in the United Kingdom. Three verbal interpretations were presented: a positive, a negative, and a neutral one, with the latter interpretation being unrelated to the participant. For each interpretation, participants had to indicate on a Likert scale

how likely they were to interpret the situation in this way. Afterward, they were forced to select the interpretation they perceived as most likely. Results showed that adolescents with increased social anxiety were more likely to have negative interpretations and less likely to have positive interpretations than adolescents with lower levels of social anxiety.

In sum, while offering more ecological validity and readily triggering emotional and related interpretational processes, few pictorial versions of interpretation bias measures have been developed to assess cognitive distortions in youth. These existing picture tasks are however not suitable for investigating interpretation bias in a more general Western-European adolescent sample as they either targeted child samples (Creswell et al., 2011; In-Albon et al., 2008) or were specifically tailored to adolescents in the United Kingdom (Haller et al., 2016). To overcome these issues, we developed a social picture task similar to Haller et al. (2016), with socially ambiguous pictures of daily school scenes for adolescents accompanied by a verbal positive and negative interpretation of the situation. Besides the scenes, there were also some other differences compared to the task of Haller et al. (2016). Specifically, we did not include neutral interpretations unrelated to the participant, because we preferred the interpretations to resolve the ambiguity of the situation. Also, after seeing a picture, first, adolescents had to select the interpretation they found matched the picture scenario best and, second, rated each interpretation in terms of how likely they found the interpretation matched the scenario. We chose this specific order because we wanted to first measure the more automatic impulsive response and afterward the more deliberate response to the interpretations. Finally, instead of making a sophisticated personalized version of the task by using pictures of participants themselves, like Haller et al. (2016) did, we used a more simplified method to enhance self-relevance. Specifically, we selected scenes in which the actors were looking toward another person who was not present in the picture itself at all, or only for a small part (e.g., only an arm was visible). In this way, participants could imagine that they were in that person's position. This resulted in a pragmatic and standardized task that can also be used for online or anonymous studies. In the current study, we investigate whether this social picture task is an appropriate method to assess interpretation bias in adolescents.

## **Current study**

The first aim of this study was to investigate how our new social picture task to assess interpretation bias is related to a more traditional verbal vignette task of interpretation bias. We expected at least a moderately positive significant correlation between the interpretation bias scores of the social picture task and the verbal vignette task. Individuals with more negative interpretation bias measured with the verbal vignettes were expected to also show more negative interpretation bias on the social pictures. The second aim of the study was to examine whether adolescents with social fears have a more negative interpretation bias on the pictorial and verbal vignette tasks. We hypothesized that individuals with higher fear of negative evaluation (i.e., the core symptom of social anxiety) and/or more general social anxiety symptoms would show more negative interpretation bias scores on both the pictorial and verbal vignettes.

For exploratory reasons, we were also interested in whether there are sex differences in the association between social fears and interpretation bias measured with both tasks. Previous research showed that girls experience more negative interpretation bias than boys (Gluck et al., 2014) and social fears are more likely to be experienced by girls than boys (Asher et al., 2017). However, it remains unclear whether the link between social fears and interpretation bias is also different for boys and girls. The current study examined these exploratory questions without forming specific hypotheses<sup>7</sup>.

## **METHODS**

This study is pre-registered. For more information and all details about the study, see <https://osf.io/b35da/>.

### **Sample**

Participants were recruited in different ways. For instance, we sent an e-mail or text message to school directors/teachers who we know from previous research

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<sup>7</sup> We also explored whether whether adolescents with social fears experience a negative interpretation bias because they over-interpret ambiguous situations in a negative way, or because they have a lack of interpreting situations in a positive way (Amir et al., 2012; Huppert et al., 2003; Steinman et al., 2020). Results of this exploratory aim can be found in the Appendices, part C and Table D.

collaborations. We also came in touch with several other school directors, via some of our friends or family members working in high schools. School directors were asked whether they could put the information about the study on their school web page, or distribute the information to the parents and adolescents via e-mail. In total, four of the seven contacted schools agreed to do this. These four secondary schools were located in different regions of the Netherlands (three in different cities in the Western, Middle, and Eastern parts and one school in a more rural area).

In total, 412 adolescents in the Netherlands participated in our online study. Participants who did not complete our main variables of interest (i.e., interpretation bias, social fears) were excluded ( $n = 8$ ). Some adolescents completed the measures in less than 15 minutes. We did not consider their answers valid, and they were therefore excluded from further analyses ( $n = 57$ ) as well. Some of these adolescents participated again in the study and took more than 15 minutes to complete the measures the second time. Their answers the second time were taken into account<sup>8</sup>. Some individuals completed the measures twice and took both times more than 15 minutes to complete them, probably because they wanted to receive the monetary reward twice. For those participants, we only considered the data from the first time they participated ( $n = 5$ ). One participant was too old for our study (19 years) and was excluded from our analyses. Finally, we ran some reliability checks to identify individuals who answered in a 'straight-line' manner (i.e., they choose the same extreme answer most of the time). We identified these participants by looking at the raw data of two self-report scales (i.e., Brief Fear of Negative Evaluation [BFNE], Rosenberg Self-Esteem Scale [RSES]) which contained reversed items. Participants who rushed through the measures inattentively may have filled in the same score to all items without noticing the reverse items (e.g., they could have simultaneously confirmed "*I am positive about myself*" and "*I feel like a failure*"). We excluded participants who filled in the same extreme score to more than 25% of the reverse-coded items compared to the non-reversed items of the BFNE and/or RSES ( $n = 12$ ).

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<sup>8</sup> After reconsideration, we thought it would be possible that certain learning effects could have taken place during this second time. We re-ran the analyses excluding these participants ( $n = 23$ ) to investigate this. However, the results with or without these participants were similar, so we decided to only report the results with these participants included.

After excluding these participants, our final sample consisted of 329 adolescents (40.1% boys) between 12 to 18 years ( $M_{age} = 15.08$ ,  $SD_{age} = 1.76$ ). The majority of our sample was in secondary school (7.6% in grade 7, 19.5% in grade 8, 17.0% in grade 9, 19.5% in grade 10, 18.8% in grade 11, and 17.0% in grade 12) but 2 adolescents (0.6%) were in higher education. Educational levels of the participants varied between pre-vocational (in Dutch: VMBO, 14.0%), pre-college (in Dutch: HAVO, 22.5%), and pre-university (in Dutch: VWO, 53.8%) or college level (in Dutch: HBO, 0.6%). Some participants followed a combination of different educational levels (9.1%). In the sample, 99.7% fully completed the measures but one participant had some missing values on the self-esteem items (5 out of the 10 items are missing for this scale). For this person, missing values were replaced using person mean imputation.

## Measures

### *Interpretation bias social picture task*

We developed a social picture task to assess interpretation bias, the Schloss Einstein-Radboud Socially Ambiguous Images (SERSAI) task. In this task 35 pictures of socially ambiguous scenarios were presented. Each scenario was accompanied by a positive and negative interpretation of the scenario. The pictures were in fact screenshots of ambiguous social scenes selected from a German television show, Schloss Einstein (Saxonia Media, <https://www.saxonia-media.de/produktionen/serien/schloss-einstein>), regarding students at a high school. Although Germany has a different school system, the setting is quite similar to the Netherlands, making the pictures to be also representative of Dutch adolescents. The two interpretations for each picture were created by the study authors. To be able to trigger self-relevance, we used pictures in which the actors looked at another person who was not at all or only partly visible (e.g., only an arm or shoulder) in the picture. This way, participants could be instructed to imagine themselves in that person's position. We conducted two pilot studies to test the valence of the pictures and the plausibility of the interpretations. For more information on these pilot studies and the selection of stimuli for the SERSAI task, please see <https://osf.io/b35da/>. The materials are available upon request by contacting the second author. Figure 1 presents an example of a trial with a picture of an ambiguous scene and the accompanying positive and negative interpretations. Table A of the Appendices presents two additional examples.

The interpretation bias social picture task consisted of two different parts. In the first part of the task, adolescents had to indicate which of the two interpretations they found matching the picture scenario best (i.e., the forced-choice part: *"Which description do you think best fits the picture?"*). We used block randomization for the forced-choice part: each participant was randomly assigned to one of the two equally sized blocks. Both blocks consisted of the same pictures and interpretations. However, for one block the first half of the pictures began with positive interpretations, and the second half of the pictures began with negative interpretations. For the second block, the order of positive or negative interpretations was reversed. Within each block, the different pictures with interpretations were randomly presented to the participant.

In the second part of the task, participants indicated for each interpretation how likely they found the interpretations matching the scenario on a Visual Analogue Scale (VAS) from -100 = *"doesn't fit at all"* to 100 = *"does fit completely"* (i.e., the free evaluation part: *"How well do you think this description fits the picture?"*). Only one interpretation was presented together with the picture and the VAS to indicate the fit of the interpretation. So, participants saw each picture twice: once with the positive interpretation and once with the negative interpretation. The pictures with interpretations were randomly presented to participants.

The whole social picture task with both the forced-choice and free evaluation parts required 105 responses from participants (i.e., 35 scenarios and three different questions per scenario), which took about 30 minutes. We calculated two interpretation bias indices. For the forced-choice part, we computed the percentage of chosen positive interpretations of the total number of situations. Percentages lower than 50% indicated that adolescents had a more negative bias, percentages higher than 50% indicated a more positive bias, and percentages around 50% represented no specific bias for a type of interpretation. For the free evaluation part of the task, we calculated a difference score between the mean score of the responses regarding the fit of the negative interpretations minus the mean score of the responses regarding the fit of the positive interpretations. A more positive score on this index indicated a more positive bias, a more negative score a more negative bias, and a difference score of around zero indicated that an adolescent had no preference for a certain interpretation type. In our sample, the inter-item reliability of the free evaluation part was good (Cronbach's  $\alpha = .94$  for both the positive and negative interpretations).

**Figure 1**

*An example trial of the interpretation bias social picture task, the Schloss Einstein-Radboud Socially Ambiguous Images (SERSAI) task.*



*“New student: You are new at school, and they would like to get to know you.” (positive)*

*“Strange student: You are new at school, but they don’t want to get to know you.” (negative)*

***Interpretation bias verbal vignette task***

Besides our own pictorial task, interpretation bias was also assessed with the more ‘classical’ approach using verbal vignettes. In total seven vignettes were used from various sources: three were adopted from the Adolescents Interpretation and Belief Questionnaire (AIBQ; Miers et al., 2008), one was from the Interpretation and Judgmental Questionnaire (IJQ; Voncken et al., 2003), one was from an interpretation bias task developed by Mobach et al. (2019) and the remaining two vignettes were created by the study authors. All vignettes described a socially ambiguous scenario, and each scenario was accompanied by a positive, negative, and neutral interpretation of the scenario. Adolescents rated for each interpretation type how likely they found this interpretation matched the scenario on a 6-point Likert scale. An example is: *“Two classmates talking to each other are looking at you. Why are they looking at you?”* with the following interpretations: *“They say something nice about me”* (positive), *“They are gossiping about me”* (negative) and *“They happen to be looking in my direction”* (neutral). Table A of the Appendices presents two additional examples. The vignettes were randomly presented to

the participants. An index for interpretation bias was received by calculating a difference score between the mean score of the positive minus the mean score of the negative interpretations. The neutral interpretations were thus not taken into account in this study. A more positive index represented a more positive bias, a more negative score a more negative bias, and a difference score around zero indicated no preference for an interpretation type. In this study, the inter-item reliability was appropriate for positive (Cronbach's  $\alpha = .76$ ) and negative interpretations (Cronbach's  $\alpha = .82$ ).

### **Social fears**

The Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983) was used to measure fear of negative evaluation, the core symptom of social anxiety. The scale has 12 items and participants indicated the extent to which each item describes themselves. An example item is *"I worry about what other people will think of me even when I know it doesn't make any difference"*. Response categories ranged from 1 = *"not at all"* to 5 = *"extremely"*. After reverse coding several items, a mean score was calculated with higher scores indicating higher fear of negative evaluation. The questionnaire has good construct, concurrent and discriminant validity and the test-retest reliability is high (Collins et al., 2005). In our study, the inter-item reliability was very good (Cronbach's  $\alpha = .93$ ).

The Social Phobia and Anxiety Inventory for Children (SPAI-C; Beidel et al., 1995) was administered to assess adolescents' more general cognitive, behavioural, and physiological aspects of social anxiety. This questionnaire consists of 26 items describing potential anxiety-provoking social situations. An example item is *"I feel scared when I have to join a big group of boys and girls (more than 6)"*. Participants indicated for each item how often they feel anxious in these situations or how often they have anxiety-related cognitions, physiological symptoms, or show behavioural avoidance in these situations via a 3-point scale (0 = *"never or hardly ever"*, 1 = *"sometimes"*, 2 = *"most of the times or always"*). Twelve items have sub-items for which first a mean score of the sub-items is calculated to represent these items. Afterward, we calculated a mean score for all 26 items, a higher score indicated more social anxiety. The SPAI-C has good discriminant and external validity (Beidel et al., 2000). Inter-item reliability of this questionnaire was excellent in our study (Cronbach's  $\alpha = .97$ ).



### ***Depressive mood***

We used the 8-item version of the Patient Health Questionnaire modified for Adolescents (PHQ-A-8; Johnson et al., 2002) to control for depressive mood as depression is highly comorbid with social fears and interpretation bias is also found to be an etiological factor for depression (Garber & Weersing, 2010). An example item is *"Feeling down, depressed or hopeless"*. Participants indicated their degree of depressive mood in the past two weeks on a scale from 0 = *"not at all"* to 3 = *"almost every day"*. A mean score was calculated for all items, with higher scores indicating higher levels of depressive mood. The psychometric properties of this scale are good (Richardson et al., 2010), with good inter-item reliability in our study (Cronbach's  $\alpha = .88$ ).

### ***Self-esteem***

The Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965) was used to control for self-esteem as individuals with heightened social fears are featured by low self-esteem (Iancu et al., 2015). This self-report scale contains 10 self-statements which have to be scored on a 4-point scale from *"strongly disagree"* to *"strongly agree"*. An example item is *"On the whole, I am satisfied with myself"*. After reversing the negatively phrased statements, we calculated a mean score of all items. A higher mean score indicated higher self-esteem. The scale has high internal consistency and congruent validity (Franck et al., 2008). In our study, the inter-item reliability of the scale was good (Cronbach's  $\alpha = .90$ ).

## **Procedure**

The informed consent and data collection procedure took place online via Qualtrics (<https://www.qualtrics.com>). For adolescents between 12-15 years old, parents first gave active consent, after which adolescents were asked to give online consent as well. After this was done, adolescents could fill in the measures using a separate link. For adolescents between 16-18 years old, parental consent was not necessary, we only needed adolescents' own active consent in order to complete the measures.

Adolescents got a monetary reward once they completed the measures (an online gift card of 10 euros) and took more than 880 seconds (about 15 minutes) to finish the study. If they took less time to complete the measures, they received an

e-mail request to fill in the measures again. Participants who filled in the measures again received the reward (regardless of whether they took more or less than 880 seconds to fill it in). Participants who did not fill in the measures again after the e-mail request did not receive a reward. Participants who filled in the measures twice and took both times more than 880 seconds, only received a gift card once. The Ethics Committee of the Faculty of Social Sciences, Radboud University in Nijmegen had no formal concerns regarding this research (code: ECSW-2020-083).

## Data analysis

All analyses were conducted in SPSS version 25. As a preliminary step, we used Pearson correlation analyses to see how the variables related to each other and we examined the descriptive statistics of the variables. Pearson correlation analyses were also used to test how the different interpretation bias measures were related to each other.

In addition, we conducted a series of hierarchical multiple linear regression analyses to investigate whether adolescents with social fears would show a negative interpretation bias. The different interpretation bias indices were used as dependent variables. Fear of negative evaluation and more general social anxiety symptoms were investigated as main predictors. In all regressions, possible covariates (i.e., depressive mood, self-esteem, and age) were entered as predictors in the first block if the Pearson correlations showed that these covariates were significantly and moderately related to the dependent variables of interpretation bias ( $p < .05$  and  $r \geq .30$ ) and if there were no issues of multicollinearity with the main predictors of social fears ( $VIF < 10$ , tolerance  $> .10$ ). Beforehand, we checked the assumptions for linear regression, and all assumptions were met for all regression analyses. All tests were two-tailed, and we used Bonferroni corrections for multiple testing (i.e., correcting the  $\alpha$ -level for significance testing by dividing it by the number of predictors in the regression analyses).

## RESULTS

Descriptive statistics are shown in Table 1 and Table 2 presents the Pearson's correlations.

## Associations between different bias measures

The Pearson correlation analyses showed that all three different interpretation bias indices of the pictorial and verbal vignette tasks correlated significantly with each other. A more negative bias score on one bias index was related to more negative bias scores on the other two bias indices. Specifically, the forced-choice bias score of the social picture task and the interpretation bias score of the verbal vignette task moderately correlated. Similarly, a moderate correlation between the free evaluation interpretation bias score of the social pictures and the interpretation bias score of the verbal vignettes was found. Thus, more negative bias scores on both indices of the social picture task were related to a more negative bias score on the verbal vignette task. Finally, the two interpretation bias indices of the pictorial task are highly correlated.

**Table 1**

*Means, standard deviations, minimum and maximum scores of all variables (N = 329)*

|   | <i>M</i> | <i>SD</i> | <i>Min</i> | <i>Max</i> |
|---|----------|-----------|------------|------------|
| <b>Interpretation bias social picture task</b>  |          |           |            |            |
| Forced choice (% positive interpretations)      | 45.86    | 22.93     | 0.00       | 100.00     |
| Free evaluation positive interpretations        | -0.14    | 33.47     | -89.69     | 80.00      |
| Free evaluation negative interpretations        | 16.71    | 31.63     | -78.11     | 94.69      |
| Free evaluation difference positive – negative  | -16.85   | 62.31     | -182.83    | 157.29     |
| <b>Interpretation bias verbal vignette task</b> |          |           |            |            |
| Positive interpretations                        | 3.71     | 0.79      | 1.71       | 6.00       |
| Negative interpretations                        | 3.62     | 0.91      | 1.14       | 6.00       |
| Difference positive – negative                  | 0.09     | 1.43      | -4.29      | 4.86       |
| <b>Self-report questionnaires</b>               |          |           |            |            |
| Fear of negative evaluation                     | 35.06    | 11.56     | 12.00      | 60.00      |
| Social anxiety in general                       | 13.61    | 10.17     | 0.00       | 47.33      |
| Depressive mood                                 | 15.19    | 5.36      | 8.00       | 31.00      |
| Self-esteem                                     | 29.75    | 5.92      | 11.00      | 40.00      |

**Table 2**  
*Pearson's correlations between all variables (N = 329)*

|   | 1. | 2.     | 3.      | 4.      | 5.      | 6.      | 7.      | 8.      | 9.      | 10.     | 11.     | 12.     |
|---|----|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. IB picture task forced choice              | -- | .89*** | -.86*** | .92***  | .35***  | -.48*** | .50***  | -.29*** | -.18**  | -.09    | .24***  | -.19*** |
| 2. IB picture task free evaluation positive   | -- | --     | -.83*** | .96***  | .29***  | -.46*** | .45***  | -.30*** | -.14*   | -.07    | .21***  | -.21*** |
| 3. IB picture task free evaluation negative   | -- | --     | --      | -.95*** | -.27*** | .42***  | -.42*** | .26***  | .16**   | .06     | -.25*** | .16**   |
| 4. IB picture task free evaluation difference | -- | --     | --      | --      | .29***  | -.46*** | .45***  | -.29*** | -.16*   | -.07    | .24***  | -.19*** |
| 5. IB verbal task positive                    | -- | --     | --      | --      | --      | -.41*** | .82***  | -.42*** | -.41*** | -.22*** | .39***  | .18**   |
| 6. IB verbal task negative                    | -- | --     | --      | --      | --      | --      | -.86*** | .43***  | .39***  | .33***  | -.30*** | .10     |
| 7. IB verbal task difference                  | -- | --     | --      | --      | --      | --      | --      | -.50*** | -.48*** | -.33*** | .41***  | .04     |
| 8. Fear of negative evaluation                | -- | --     | --      | --      | --      | --      | --      | --      | .65***  | .40***  | -.61*** | -.02    |
| 9. Social anxiety in general                  | -- | --     | --      | --      | --      | --      | --      | --      | --      | .43***  | -.54*** | -.20**  |
| 10. Depressive mood                           | -- | --     | --      | --      | --      | --      | --      | --      | --      | --      | -.52*** | -.02    |
| 11. Self-esteem                               | -- | --     | --      | --      | --      | --      | --      | --      | --      | --      | --      | -.01    |
| 12. Age                                       | -- | --     | --      | --      | --      | --      | --      | --      | --      | --      | --      | --      |

Note. IB = interpretation bias. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

## **Negative interpretation bias in adolescents with heightened social fears**

We performed three different hierarchical multiple regression analyses to investigate whether individuals with higher social fears (fear of negative evaluation as a core symptom of social anxiety and more general social anxiety symptoms) would have more negative interpretation bias measured with the social picture task (separately for the forced-choice and free evaluation part) and verbal vignette task. All regression coefficients of these analyses are shown in Table 3.

### ***Social picture task: forced choice***

In the first regression, the forced-choice index of the pictorial interpretation bias task was the dependent variable, and fear of negative evaluation and general social anxiety were entered as predictors. No covariates were taken into account because the correlations between the dependent variable and the possible covariates of self-esteem, depressive mood, and age were non-significant and/or small ( $p > .05$  and/or  $r < .30$ ). The Bonferroni corrected  $\alpha$ -level was .025. The model was significant,  $F(2, 326) = 14.45, p < .001, R^2 = .08$ . Results showed that more fear of negative evaluation significantly predicted more negative bias on this forced choice interpretation bias index. However, more general social anxiety was not a significant predictor of this index.

### ***Social picture task: free evaluation***

In the second regression, the free evaluation interpretation bias difference score of the pictorial interpretation bias task was the dependent variable. Again, no covariates were taken into account (due to similar reasons as in the first regression), and fear of negative evaluation, as well as general social anxiety symptoms, were entered as predictors (Bonferroni corrected  $\alpha$ -level = .025). This model was significant,  $F(2, 326) = 15.27, p < .001, R^2 = .09$ . More fear of negative evaluation predicted more negative bias but social anxiety in general did not.

### ***Verbal vignette task***

In the third regression, the interpretation bias difference score of the verbal vignette task was the dependent variable. Depressive mood and self-esteem were entered as covariates in the first block as these were significantly and moderately related to

the dependent variable ( $p < .05$  and  $r > .30$ ). Age was not included as a covariate as it did not relate to interpretation bias measured with the verbal vignettes. Fear of negative evaluation and more general social anxiety were entered as predictors in the second block. The Bonferroni corrected  $\alpha$ -level was .0125.

The first block with the covariates was significant,  $F(2, 326) = 37.13, p < .001, R^2 = .19$ . Lower self-esteem and higher depressive mood predicted more negative bias on this scale. After the main predictors were entered in the second block, the model remained significant,  $F(4, 324) = 35.15, p < .001, R^2 = .30$ . Besides, adding fear of negative evaluation and general social anxiety to the model led to a significant improvement,  $F_{\text{change}}(2, 324) = 27.20, p < .001, R^2_{\text{change}} = .12$ . In this block, self-esteem and depressive mood were no longer significant predictors of interpretation bias. Higher levels of fear of negative evaluation and social anxiety in general predicted more negative interpretation bias with the verbal vignette task.

**Table 3**

*Results of three multiple regression analyses predicting interpretation bias by social fears (N = 329)*

|  | <i>B</i> | <i>B<sub>SE</sub></i> | <i>β</i> | <i>t</i> | <i>p</i> |
|--|----------|-----------------------|----------|----------|----------|
| <b>1. Interpretation bias social picture task forced choice</b>              |          |                       |          |          |          |
| Fear of negative evaluation  | -7.04    | 1.66                  | -.30     | -4.23    | <.001    |
| Social anxiety in general  | 0.98     | 4.10                  | .02      | 0.24     | .812     |
| <b>2. Interpretation bias social picture task free evaluation difference</b> |          |                       |          |          |          |
| Fear of negative evaluation  | -21.08   | 4.51                  | -.33     | -4.67    | <.001    |
| Social anxiety in general  | 8.92     | 11.11                 | .06      | 0.80     | .423     |
| <b>3. Interpretation bias verbal vignette task difference</b>                |          |                       |          |          |          |
| Step 1:  |          |                       |          |          |          |
| Depressive mood  | -0.35    | 0.13                  | -.16     | -2.78    | .006     |
| Self-esteem  | 0.78     | 0.14                  | .32      | 5.52     | <.001    |
| Step 2:  |          |                       |          |          |          |
| Depressive mood  | -0.18    | 0.12                  | -.08     | -1.52    | .130     |
| Self-esteem  | 0.18     | 0.15                  | .08      | 1.18     | .239     |
| Fear of negative evaluation  | -0.41    | 0.10                  | -.28     | -4.15    | <.001    |
| Social anxiety in general  | -0.81    | 0.23                  | -.22     | -3.45    | .001     |

### **Sex differences in the association between social fears and interpretation bias**

We also explored whether there were sex differences in how social fears and interpretation bias were related. We created two interaction terms with sex for

both fear of negative evaluation and social anxiety symptoms in general. Before creating these interaction terms, the social fears variables were centred. We repeated the three regression analyses described above but we added the direct effect of sex to the block of the direct effects of fear of negative evaluation and social anxiety in general. Then, we added the two interaction terms in a subsequent block. Bonferroni corrected  $\alpha$ -levels were .01 for the regressions with the picture task and  $\alpha = .0071$  for the vignette task. For all three regressions with the different interpretation bias indices of the pictorial and verbal vignette tasks as dependent variables, neither sex as a direct effect, nor the interaction effects of sex were significant. Regression coefficients of these analyses can be found in Table B of the Appendices.

## **DISCUSSION**

This study investigated whether our newly developed social picture task was an appropriate instrument to assess interpretation bias related to social fears in adolescents. Specifically, we examined how the pictorial task was related to interpretation bias measured with a more traditional verbal vignette task and to levels of fear of negative evaluation (the core fear of social anxiety) and social anxiety symptoms in general. We also explored sex differences in the associations between interpretation bias and social fears.

### **Associations between different bias measures and the link with social fears**

Results showed that the new social picture task was moderately correlated with a more traditional verbal vignette task. As expected, both tasks thus measure a similar construct, and the pictorial task was able to assess interpretation bias in adolescents. This is the first proof of the convergent validity of the pictorial task. Adolescents with higher levels of fear of negative evaluation were found to have a more negative interpretation bias, detected by both the pictorial as well as the verbal task. Contrary to our expectations, the two tasks were differentially related to more general social anxiety symptoms: while adolescents with higher levels of social anxiety in general had more negative interpretation bias on the verbal task, this effect was not found for the pictorial task.

This finding is striking and could imply that the picture task can grasp the more cognitive and emotional components of social anxiety, namely fear of negative evaluation but fails to detect physical and behavioural social anxiety symptoms. This finding makes sense because the social scenes and the accompanying interpretations used in the task mostly target cognitive components (by asking what adolescents would *think* in these ambiguous situations) but do not ask specifically how adolescents would react or behave in such a situation. This idea was supported by the data as the correlations between the pictorial task and social anxiety in general, were mostly non-significant for the behavioural and physical items but significant for the more cognitive items. However, it can be questioned how valid this explanation is since the verbal task was related to social anxiety in general even though this task also only specifically asks about how adolescents would interpret the situations (so a cognitive component), instead of also targeting behavioural and physical aspects of social anxiety.

A recent meta-analysis investigating interpretation bias in social anxiety revealed larger effect sizes when verbal stimuli were used rather than visual stimuli (Chen et al., 2020). However, the studies using visual stimuli included in this meta-analysis used static pictures or videos of facial expressions or videos of social situations or behaviours. The type of stimuli in our task (i.e., static pictures of social situations) was thus not taken into account in the meta-analysis. Chen et al. (2020) showed that the effect sizes were specifically smaller for facial stimuli ( $g = 0.60$ ), while videos of social situations had large effect sizes ( $g = 0.86$ ) similar to verbal stimuli ( $g = 0.89-0.99$ ). So, their conclusion was mainly driven by the facial stimuli that had been used. Facial stimuli have some disadvantages in measuring interpretation bias as they do not provide a social context, so the stimuli are too simplistic and may not be ecologically valid or do not allow much interpretative space as most facial expressions are accurately recognized (Bijsterbosch et al., 2021; Blanchette & Richards, 2010; Chen et al., 2020; Gaskell & Marslen-Wilson, 2001). Therefore, we chose pictures of social scenarios instead. The meta-analysis has also focused on studies with adult participants only. Since it is more difficult for adolescents than adults to imagine themselves in a situation without visual cues (Burnett Heyes et al., 2013), it could be expected that the pictorial task would be able to assess social anxiety in general to a similar degree or produce even larger effect sizes than the verbal task. In sum, we had reason to believe that our pictorial task would be



better able to grasp interpretation bias than the verbal tasks. However, this was not supported by our data and our results were in line with the meta-analysis of Chen et al. (2020) after all.

An explanation for the differential links with general social anxiety symptoms between the two interpretation bias tasks could be that the pictorial and verbal tasks tap into a different type of processing. Pictures are more quickly processed (de Houwer & Hermans, 1994), provide more details, and leave less room for own personal imagination than verbal descriptions. This can be compared with reading a book versus seeing a movie: though the storyline might be the same, the book leaves more room to own interpretation of the characters and the situation than the movie. Indeed, it is found that when reading a text, individuals tend to make a mental image of the information (Denis, 1982) allowing for heightened self-relevance with the verbal vignettes compared to the pictorial task. Specifically, when reading a vignette, individuals may rethink a situation that occurred to them, filling in the details of the abstract text with personal memories (e.g., thinking of a certain person in your mind when reading the vignettes). As a result of this heightened personal imagination, verbal vignettes perhaps also tap more into memory processes, than merely interpretation bias. Contrary, due to the concrete detailed pictures, there is less room for personal imagination in the pictorial task allowing for a more specific measure of interpretation bias for hypothetical situations with unfamiliar peers. It could therefore be that the pictorial task was only related to the core symptom of social anxiety, fear of negative evaluation, as a response to the specific ambiguous scenario depicted, while the abstract verbal vignettes were also related to more general social anxiety symptoms. Two previous studies investigating the effectiveness of a pictorial version of CBM-I support the idea that pictorial stimuli may reduce self-relevance. Specifically, participants had more difficulties engaging with the unfamiliar visual stimuli than with verbal stimuli (Lisk et al., 2018), and participants in the pictorial training found it harder to concentrate and were not able to imagine the scenes very vividly (de Voogd et al., 2017).

### **Sex differences in the association between social fears and interpretation bias**

Contrary to a previous study showing that girls experience more negative interpretation bias than boys (Gluck et al., 2014), we found no sex differences in

the levels of interpretation bias. Besides, sex did not play a moderating role in the association between social fears and interpretation bias in this study. This implies that the cognitive theories regarding interpretation bias and social fears similarly apply to boys and girls, and this idea was also supported by a recent meta-analysis showing that the variance in effect size between interpretation bias and anxiety was not accounted for by sex (Stuijzand et al., 2018). However, we would like to point out that the sample consisted of a larger part of girls than boys (59.9% versus 40.1%), resulting in an unequal comparison. At the same time, we examined a broad age range of adolescents, from 12 to 18 years old. It could be that sex differences are more pronounced during a specific period in adolescence as a result of pubertal changes (Hayward & Sanborn, 2002). Due to power issues, we were not able to investigate sex differences for the specific age groups. Future studies using more balanced sex distributions and examining sex differences for specific age groups should reveal whether the link between interpretation bias and social fears is indeed equal for boys and girls.

### **Strengths, limitations, and future directions**

The current study was a first step in showing the utility of a social picture task to measure interpretation bias in adolescents. The pictorial task included ecologically valid pictures of daily social interactions between adolescents. Self-relevance was enhanced in this task by using pictures for which participants could imagine the actors were looking at them. One of the major strengths of the study was the large sample of adolescents from varying educational backgrounds.

This study was not without limitations. First of all, due to feasibility issues, we selected the materials based on pilot studies with adult samples instead of with adolescents. This is not optimal as previous studies showed clear differences between validating a stimuli set based upon child or adult participants (LoBue et al., 2018; LoBue & Thrasher, 2015). Although the final selection of stimuli seems to measure interpretation bias in adolescents, we could re-run the pilot studies with adolescents to examine whether similar stimuli would be selected for the pictorial task. Second, we assumed that adding pictures would be beneficial in order to measure interpretation bias due to enhanced imagination and self-relevance. However, we did not formally test these assumptions, nor did we ask questions about the acceptability and user experience of the task among adolescents. Follow-

up studies would benefit by including more subjective questions about these topics in order to conclude whether or not the pictorial task improved ecological validity and social salience, and whether it is user-friendly. Third, data collection of this study took place during the coronavirus (i.e., COVID-19) pandemic. This study did not include questions regarding the experience of anxiety feelings associated with COVID-19. However, on second thought, this would have been worthwhile due to the fact that COVID-19 had a direct effect on adolescents' ability to engage in social interactions as high schools were closed and adolescents were not permitted to sport or hang out with their peers. The corona situation could have influenced the results, for instance by increasing levels of social anxiety or depressive mood (Magson et al., 2021). Fourth, it should be noted that the order of the questions in the pictorial task may have impacted the results. Participants first responded to the forced-choice part of the pictorial task, before the free evaluation questions were asked. In line with the idea of confirmation bias, participants may have answered the free evaluation part in a more extreme way to match their forced-choice responses. Future research should counterbalance the order across participants to investigate this. Finally, all data were cross-sectional, meaning that we cannot draw any conclusions regarding the direction of the relationship between interpretation bias and social fears. By using longitudinal or experimental designs in the future, more straightforward conclusions would be possible.

Future research should formally investigate the psychometric properties of this task by testing for instance its test-retest reliability, content validity, and construct validity. The current pictorial task is lengthy (105 responses were needed from participants) as we were interested in how adolescents would interpret different situations and whether the answer format used (forced-choice or free evaluation) would matter. We would advise other researchers to shorten the pictorial task for reasons of practicality. This could be done by either using only certain social themes (depending upon the topic of interest) or by using only one answer category as the correlation between the forced-choice and free evaluation answers was very high ( $r = .92$ ). If only the forced-choice response category is used, it would limit the total responses needed to 35.

Also, it would be beneficial to investigate how different samples react to the social picture task. First, the pictorial task could especially be beneficial for individuals with reading difficulties, such as dyslexia, as it relies less heavily on the

understanding of abstract verbal information. It would be interesting to compare how adolescents with limited literacy skills score on the pictorial and verbal vignette task, to see if the picture task is better able to grasp their interpretation bias. Another idea to improve the task for this target group would be to audio-record the interpretations, so adolescents with reading difficulties do not have to read the interpretations themselves. Second, although most studies agree upon the fact that social anxiety can be understood as a severity continuum from shyness to social anxiety disorder (Ruscio, 2010), it would also be important to investigate how the findings of the current study generalize to adolescents with clinical levels of social anxiety.

This picture task may be helpful for researchers who are interested in the link between different cognitive biases, such as attention bias (i.e., the attentional preference for negative stimuli) and interpretation bias. The Cognitive Combined Bias Hypothesis assumes that these biases do not operate in isolation but rather influence and interact with each other (Hirsch et al., 2006). Up until now most studies failed to investigate this or used different modalities for their attention bias and interpretation bias task (e.g., verbal stimuli for interpretation bias, visual stimuli for attention bias), making it more difficult to investigate the supposed link between cognitive biases. From the current stimuli set, we also selected more positive and negative social situations (instead of only ambiguous situations as used in the current study). These positive and negative stimuli could be used in the future to develop a task to measure attention bias, for instance by using a free viewing paradigm with an eye-tracker while participants select the most fitting interpretation. The current stimuli set thus provides possibilities to measure both attention bias and interpretation bias with the same stimuli, facilitating research on the link between different biases.

## **Conclusion**

This study contributes to the current field of research by developing a new social picture task to measure interpretation bias. The pictorial task was found to be able to assess interpretation bias in adolescents comparable to the verbal task, hinting at appropriate convergent validity. The social picture task could also identify interpretation bias in adolescents with a heightened fear of negative evaluation, the core symptom of social anxiety but not for adolescents with social anxiety

symptoms in general. The traditional verbal task was however linked to both social fears and thus at the moment still seems the preferred method to investigate interpretation bias related to social fears in adolescents.



We assumed that by adding pictures to verbal interpretations of socially ambiguous scenarios, this task increased ecological validity and social salience compared to the more traditional ways of measuring interpretation bias with verbal vignettes. Also, by using pictures to illustrate ambiguous scenarios, this task may have been less dependent upon participants' literacy skills. However, future research should formally test these assumptions, further validate the new task and test its acceptability among adolescents. Doing so will hopefully help to improve the current pictorial task. If improved in the future, the pictorial task could be beneficial to investigate the link between attention bias and interpretation bias using the same stimuli and it may function as a pre-post measure for pictorial versions of CBM-I. Possibly the task may contribute to a better understanding of the development and maintenance of social fears in adolescence and eventually be able to prevent and treat mental health problems in later life.

## **ACKNOWLEDGEMENTS**

We would like to thank all school directors, teachers, parents and adolescents for their participation in our study. We would also like to thank the producers of Saxonia Media, and in particular Yvonne Abele, Anne Schmidt and Josefne Bohlken, for providing us with the video material of Schloss Einstein, which made it possible to develop the interpretation bias social picture task.

# APPENDICES

**Table A**  
Two example trials of the pictorial and verbal task

|                         | Pictorial task   | Verbal task  |
|-------------------------|--|--|
| Scenario                |              | You are all alone somewhere at a school party and someone you don't know is looking at you.  |
| <b>Example 1</b>        |  |  |
| Question                | Which description do you think best fits the photo?  | Why is he/she looking at you?  |
| Positive interpretation | Getting attention<br>He is trying to get your attention so that you will come and talk to him. | He/she likes me and thus tries to get my attention.  |
| Negative interpretation | Lonely<br>He looks at you and thinks you are a loser because you are alone.                    | He/she notices that I am alone. He/she probably thinks I'm pathetic.   |
| Neutral interpretation  | -  | He/she happens to be looking in my direction.  |
| Scenario                |              | You are in conversation with someone, and you are telling them something. In the middle of a sentence, this person interrupts you. |
| <b>Example 2</b>        |  |  |
| Question                | Which description do you think best fits the photo?  | Why is this person interrupting you?   |
| Positive interpretation | Interesting<br>She listens intently to what you have to say.                                   | This person is very interested in what I am saying and wants to know more about it.  |
| Negative interpretation | Bored<br>She thinks your story is boring, so her mind is off it.                               | This person does not find what I am saying fascinating and wants to change the subject.  |
| Neutral interpretation  | -  | This person did not understand something correctly and wants to ask if I can repeat it.  |

**Table B**

Results of three multiple regression analyses examining sex differences in the relation between social fears and interpretation bias ( $N = 329$ )

|  | <b>B</b> | <b>B<sub>SE</sub></b> | <b>β</b> | <b>t</b> | <b>p</b> |
|--|----------|-----------------------|----------|----------|----------|
| <b>1. Interpretation bias social picture task forced choice</b>              |          |                       |          |          |          |
| Step 1: $F(3, 325) = 10.88, p < .001, R^2 = .09$                             |          |                       |          |          |          |
| Fear of negative evaluation*   | -7.16    | 1.66                  | -.30     | -4.31    | <.001    |
| Social anxiety in general  | 0.50     | 4.09                  | .01      | 0.12     | .903     |
| Sex  | 4.66     | 2.49                  | .10      | 1.87     | .062     |
| Step 2: $F(5, 323) = 6.75, p < .001, R^2 = .10$                              |          |                       |          |          |          |
| Fear of negative evaluation*   | -9.41    | 2.64                  | -.40     | -3.56    | <.001    |
| Social anxiety in general  | 4.00     | 7.10                  | .07      | 0.56     | .573     |
| Sex  | 4.73     | 2.50                  | .10      | 1.89     | .059     |
| Sex - Fear of negative evaluation  | 3.61     | 3.29                  | .13      | 1.10     | .273     |
| Sex - Social anxiety in general  | -2.27    | 3.41                  | -.08     | -0.67    | .505     |
| <b>2. Interpretation bias social picture task free evaluation difference</b> |          |                       |          |          |          |
| Step 1: $F(3, 325) = 11.04, p < .001, R^2 = .09$                             |          |                       |          |          |          |
| Fear of negative evaluation*   | -21.34   | 4.50                  | -.33     | -4.74    | <.001    |
| Social anxiety in general  | 7.84     | 11.10                 | .05      | 0.71     | .481     |
| Sex  | 10.55    | 6.76                  | .08      | 1.56     | .119     |
| Step 2: $F(5, 323) = 7.57, p < .001, R^2 = .11$                              |          |                       |          |          |          |
| Fear of negative evaluation*   | -31.07   | 7.13                  | -.48     | -4.36    | <.001    |
| Social anxiety in general  | 8.09     | 19.17                 | .05      | 0.42     | .673     |
| Sex  | 11.41    | 6.75                  | .09      | 1.69     | .092     |
| Sex - Fear of negative evaluation  | 15.59    | 8.88                  | .20      | 1.76     | .080     |
| Sex - Social anxiety in general  | -1.52    | 9.21                  | -.02     | -0.17    | .869     |
| <b>3. Interpretation bias verbal vignette task difference</b>                |          |                       |          |          |          |
| Step 1: $F(2, 326) = 37.13, p < .001, R^2 = .19$                             |          |                       |          |          |          |
| Depressive mood*   | -0.35    | 0.13                  | -.16     | -2.78    | .006     |
| Self-esteem*   | 0.78     | 0.14                  | .32      | 5.52     | <.001    |
| Step 2: $F(5, 323) = 28.03, p < .001, R^2 = .30$                             |          |                       |          |          |          |
| Depressive mood  | -0.18    | 0.12                  | -.08     | -1.49    | .138     |
| Self-esteem  | 0.18     | 0.16                  | .08      | 1.18     | .241     |
| Fear of negative evaluation*   | -0.41    | 0.10                  | -.28     | -4.14    | <.001    |
| Social anxiety in general*   | -0.81    | 0.23                  | -.22     | -3.45    | .001     |
| Sex  | -0.01    | 0.14                  | -.00     | -0.04    | .969     |
| Step 3: $F(7, 321) = 20.33, p < .001, R^2 = .31$                             |          |                       |          |          |          |
| Depressive mood  | -0.17    | 0.12                  | -.08     | -1.40    | .164     |
| Self-esteem  | 0.21     | 0.16                  | .09      | 1.33     | .183     |
| Fear of negative evaluation  | -0.33    | 0.15                  | -.23     | -2.21    | .028     |
| Social anxiety in general  | -0.57    | 0.39                  | -.16     | -1.44    | .151     |
| Sex  | -0.02    | 0.14                  | -.01     | -0.15    | .882     |
| Sex - Fear of negative evaluation  | -0.11    | 0.18                  | -.06     | -0.63    | .531     |
| Sex - Social anxiety in general  | -0.12    | 0.19                  | -.07     | -0.64    | .521     |

Note. \* Significant predictor in the model.

## **Part C Exploratory analyses: positive versus negative bias**

### ***Introduction***

We also explored whether adolescents with social fears experience a negative interpretation bias because they over-interpret ambiguous situations negatively, or because they have a lack of interpreting situations positively (Amir et al., 2012; Huppert et al., 2003; Steinman et al., 2020).

### ***Methods***

To investigate this, we calculated four extra interpretation bias indices. For the free evaluation part of the pictorial task, we calculated the mean score of the responses regarding the fit of the positive interpretations and the mean score of the responses regarding the fit of the negative interpretations. For the verbal vignette task, we also calculated the mean score of the responses to the positive interpretations and the mean score of the responses to the negative interpretations.

### ***Results***

Four regression analyses were conducted, with the mean negative and mean positive scores of the free evaluation part of the social picture task and the verbal vignette task as four dependent variables. Table 5 presents the regression coefficients of these analyses.

#### ***Social picture task - positive and negative interpretations.***

No covariates were taken into account for the regressions of the social picture task (due to similar reasons as described in the manuscript). Fear of negative evaluation and general social anxiety were entered as predictors in the first block (Bonferroni corrected  $\alpha$ -levels for both regressions were .025). The results of these two regression analyses were comparable. Both models were significant. More fear of negative evaluation predicted the tendency to have less positive and more negative interpretations. General social anxiety symptoms were not related to positive or negative interpretations.

#### ***Verbal vignette task - positive and negative interpretations.***

For the regression of the positive interpretations of the verbal vignette task, self-esteem was added as a covariate in the first block. For the regression of the



negative interpretations of the verbal vignettes, both self-esteem and depressive mood were added as covariates in the first block. For both regression analyses, fear of negative evaluation and social anxiety in general were added as predictors in the second block. The Bonferroni corrected  $\alpha$ -level for positive interpretation = .0167; and for negative interpretation = .0125.

For the positive interpretations, the model with the covariate only was significant. More self-esteem predicted more positive interpretations. After the social fear variables were added, self-esteem was still a significant predictor of positive interpretations and the model remained significant. Adding fear of negative evaluation and more general social anxiety to the model led to a significant change in model fit,  $F_{\text{change}}(2, 325) = 15.38, p < .001, R^2_{\text{change}} = .07$ . Higher levels of fear of negative evaluation and more general social anxiety symptoms predicted lower positive interpretations with the verbal vignette task.

For the negative interpretations, the model with the covariates only was significant. More depressive mood and lower self-esteem predicted more negative interpretations. After the main predictors were entered in the second block, the model remained significant. Adding the social fear variables to the model led to a significant change in fit,  $F_{\text{change}}(2, 324) = 19.33, p < .001, R^2_{\text{change}} = .09$ . In this block, self-esteem was no longer a significant predictor of negative interpretations, but the depressive mood was. Higher levels of fear of negative evaluation predicted more negative interpretations with the verbal vignette task but more general social anxiety was not a significant predictor.

## **Discussion**

Individuals with higher levels of fear of negative evaluation are inclined to interpret situations negatively but also lack positive interpretations of social situations on both the pictorial and verbal vignette tasks. This finding was not replicated for more general social anxiety feelings. Specifically, social anxiety in general was not related to positive or negative interpretations measured with the pictorial task at all. For the verbal task, individuals with more general social anxiety symptoms showed a lack of positive interpretations of situations but did not tend to interpret situations more negatively.

These findings are in line with researchers arguing that negative and positive interpretations are not opposite ends of the same continuum (Amir et al.,

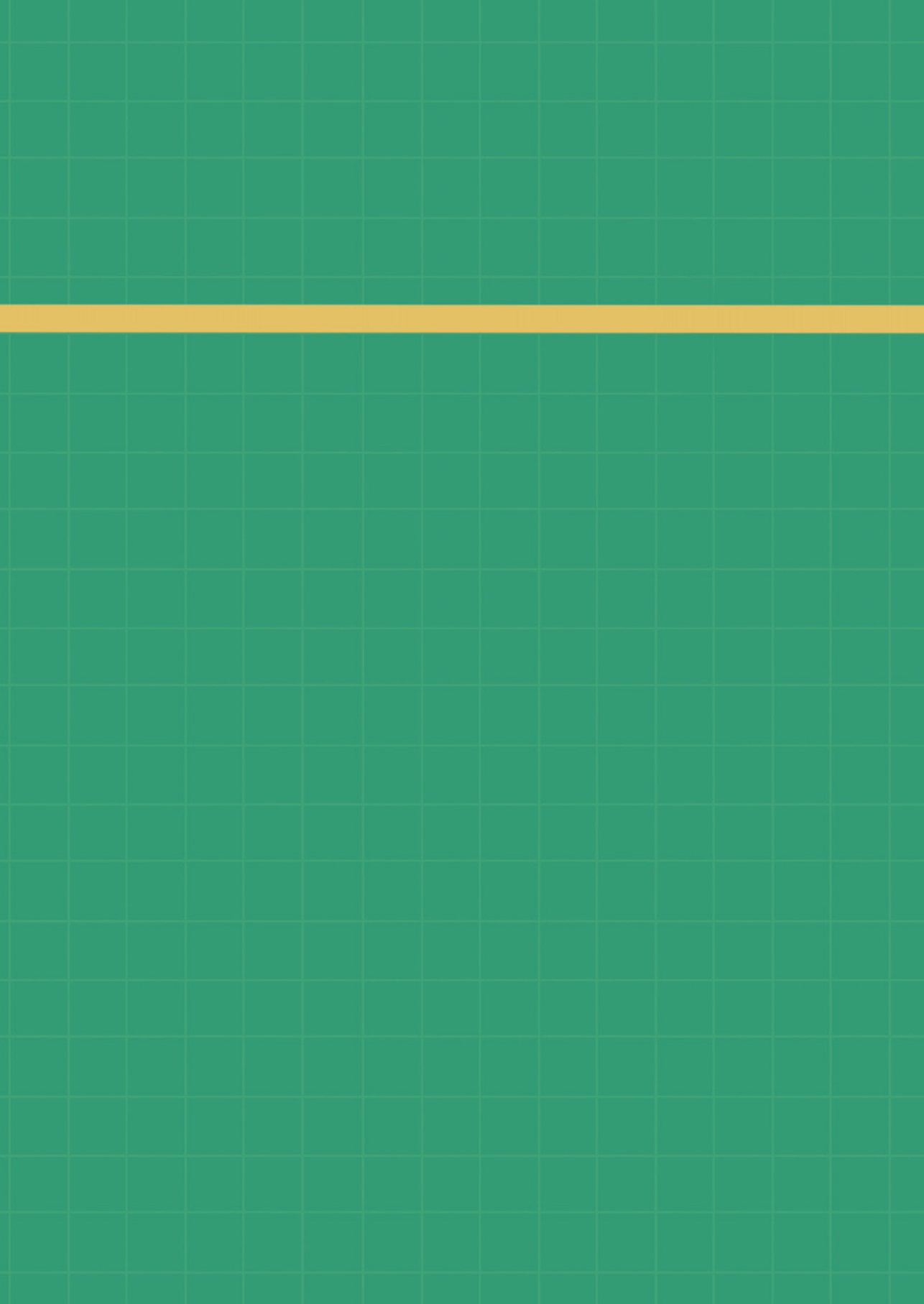
2012; Huppert et al., 2003; Steinman et al., 2020). Previous results were mixed, with some studies showing that adolescents with higher levels of social anxiety simultaneously rated positive interpretations as less likely and negative interpretations as more likely (Amir et al., 2012; Haller et al., 2016), while others found a stronger association between anxiety and the preference for threat interpretations (Huppert et al., 2003), or found that socially anxious individuals are mostly characterized by a lack of a preference for benign interpretations (Hirsch & Mathews, 2000). Our results further complicated the issue, as the link with positive versus negative interpretations was different for social anxiety in general and for the core fear of social anxiety, fear of negative evaluation, specifically. It is thus important to further investigate this issue by examining interpretation bias as a dimensional construct.

**Table D**

*Results of four multiple regression analyses examining if adolescents with social fears have a lack of positive interpretations or overuse negative interpretations (N = 329)*

|   | <i>B</i> | <i>B</i> <sub>SE</sub> | <i>β</i> | <i>t</i> | <i>p</i> |
|---|----------|------------------------|----------|----------|----------|
| <b>1. Social picture task positive interpretations</b>  |          |                        |          |          |          |
| Step 1: $F(2, 326) = 16.78, p < .001, R^2 = .09$        |          |                        |          |          |          |
| Fear of negative evaluation*                            | -12.52   | 2.41                   | -.36     | -5.19    | <.001    |
| Social anxiety in general                               | 8.45     | 5.94                   | .10      | 1.42     | .156     |
| <b>2. Social picture task negative interpretations</b>  |          |                        |          |          |          |
| Step 1: $F(2, 326) = 11.53, p < .001, R^2 = .07$        |          |                        |          |          |          |
| Fear of negative evaluation*                            | 8.56     | 2.31                   | .26      | 3.70     | <.001    |
| Social anxiety in general                               | -0.47    | 5.70                   | -.01     | -0.83    | .934     |
| <b>3. Verbal vignette task positive interpretations</b> |          |                        |          |          |          |
| Step 1: $F(1, 327) = 58.50, p < .001, R^2 = .15$        |          |                        |          |          |          |
| Self-esteem*  | 0.52     | 0.07                   | .39      | 7.65     | <.001    |
| Step 2: $F(3, 325) = 31.47, p < .001, R^2 = .23$        |          |                        |          |          |          |
| Self-esteem*  | 0.23     | 0.09                   | .17      | 2.66     | .008     |
| Fear of negative evaluation*                            | -0.15    | 0.06                   | -.18     | -2.56    | .011     |
| Social anxiety in general*                              | -0.41    | 0.13                   | -.21     | -3.09    | .002     |
| <b>4. Verbal vignette task negative interpretations</b> |          |                        |          |          |          |
| Step 1: $F(2, 326) = 25.16, p < .001, R^2 = .13$        |          |                        |          |          |          |
| Depressive mood*  | 0.32     | 0.08                   | .24      | 3.98     | <.001    |
| Self-esteem*  | -0.27    | 0.09                   | -.18     | -2.95    | .003     |
| Step 2: $F(4, 324) = 23.66, p < .001, R^2 = .23$        |          |                        |          |          |          |
| Depressive mood*  | 0.24     | 0.08                   | .17      | 2.97     | .003     |
| Self-esteem   | 0.07     | 0.10                   | .04      | 0.65     | .514     |
| Fear of negative evaluation*                            | 0.26     | 0.07                   | .28      | 3.96     | <.001    |
| Social anxiety in general                               | 0.37     | 0.16                   | .16      | 2.40     | .017     |

Note. \* Significant predictor in the model.



# Chapter 4

## Prospective associations between social status and social anxiety in early adolescence

## **ABSTRACT**

This study examined the transactional longitudinal association between social status (likeability, popularity) and social anxiety symptoms (fear of negative evaluation, social avoidance and distress), and explored gender differences in this association. Participants included 274 adolescents (136 boys,  $M_{\text{age}} = 12.55$ ). Data were collected in two waves with a six-month interval. Likeability and popularity were measured with peer nominations, social anxiety symptoms with self-reports. Autoregressive cross-lagged path models showed relative stability of social status and social anxiety. Girls who were seen as less popular by their classmates avoided social situations more frequently and experienced more distress during such situations over time. These results highlight the importance of distinguishing between different social status components and social anxiety symptoms and taking gender into account. Early support for less popular girls seems important to prevent more severe consequences of avoidance and distress, such as social exclusion and victimization.

**Keywords:** social status; social anxiety; gender; early adolescence

## INTRODUCTION

During adolescence, the peer context becomes increasingly complex and salient for well-being (Brown & Larson, 2009). Making a positive impression on others, obtaining social approval (LaFontana & Cillessen, 2010), and establishing a high position in the social hierarchy (Pellegrini & Long, 2002) become important. Social status is divided into *popularity*, described by dominance and power, and *likeability*, reflected by affiliation, intimacy, and support. Popularity and likeability are distinct constructs (Cillessen & Rose, 2005; Parkhurst & Hopmeyer, 1998) and low to moderately correlated: popular adolescents are not necessarily well-liked and vice versa (Cillessen & Marks, 2011).

Early adolescence is also characterized by increasing social anxiety (Mancini et al., 2005). Social anxiety is common with 5-16% of adolescents reporting clinical levels (Weiss & Last, 2001). Social anxiety is typically subdivided into two symptom clusters: fear of negative evaluation (FNE) and social avoidance and distress (SAD). FNE reflects fear or worry regarding negative peer evaluations. SAD entails social inhibition or avoidance and the experience of distress or discomfort during situations (la Greca & Stone, 1993). These symptoms are only moderately correlated: some individuals with high FNE function adequately in social situations, whereas others experience distress and are avoidant (la Greca & Lopez, 1998). FNE and SAD are also differentially related to other constructs. FNE relates more strongly to depressive and general anxiety symptoms than SAD (Inderbitzen-Nolan & Walters, 2000). Neglected and rejected children show similar degrees of FNE but SAD is more prominent in neglected children (la Greca & Stone, 1993). SAD also relates more strongly to poor friendship quality and self-perceived friendship competency than FNE (la Greca & Lopez, 1998).

Low status and high social anxiety negatively impact well-being. Low popularity and likeability are associated with victimization (de Bruyn et al., 2010) and aggression (Prinstein & Cillessen, 2003; Stoltz et al., 2016). Heightened social anxiety relates to school drop-out, troublesome relationships (Stein & Kean, 2000), other fears, depression, and substance abuse (American Psychiatric Association, 2013). Once established, a chronic and unremitting course is likely: social status is highly stable across adolescence (Lu Jiang & Cillessen, 2005), and 61.5% diagnosed with social anxiety report symptoms throughout life (Chartier et al., 1998). To prevent the

persistent course and negative outcomes of low status and high social anxiety, it is crucial to understand how these constructs are related. Investigation during early adolescence is important as this is the developmental period in which problems with status and social anxiety augment.

### **The transactional model**

The transactional model assumes that social anxiety and social status are reciprocally related. Social anxiety may cause adolescents to trigger negative peer reactions, which in turn perpetuate social anxiety (Kochel et al., 2012; Parker et al., 2005). The transactional model integrates two other models, each explaining a different direction of the relation (Morris, 2001; Ollendick & Hirshfeld-Becker, 2002). *The symptoms-driven model* suggests that individuals with social anxiety evoke problematic peer relationships themselves. They may have social deficits which are not favoured by peers, may self-select maladaptive relationships, or their internalizing behaviour may signal vulnerability which makes them easy targets for victimization (Kochel et al., 2012). Such negative peer relationships may, in turn, enhance the prospective risk of social anxiety, as the *interpersonal risk model* argues that social anxiety arises in a social environment when relationships are conflicting and unsupportive. Poor peer relations are stressful as they interfere with the human need to belong and need for support, thereby increasing social anxiety (Kochel et al., 2012; Sentse et al., 2017). As such, from a theoretical point of view, there may be a transactional relationship between social anxiety and peer status.

There is some empirical evidence for the transactional model as victimization (i.e., an indicator of peer status) was both a predictor and a consequence of social anxiety (Siegel et al., 2009). However, most studies investigated only one direction of the relation. Studies focusing on the symptoms-driven framework showed that peers rated the social skills of socially anxious individuals as poor (Miers et al., 2010) and social anxiety predicted victimization 1 year later (Storch et al., 2005). Socially anxious youth often had friends with similar degrees of social anxiety, thereby socializing each other into becoming more anxious (van Zalk, van Zalk, Kerr, et al., 2011). Similarly, there is also evidence for the interpersonal risk model. Adolescents with more friends decreased in social anxiety due to the experienced care (van Zalk & van Zalk, 2015). Besides, being part of a low-status crowd elevated

social anxiety as interactions with peers outside the crowd diminished (van Zalk, van Zalk, & Kerr, 2011), and low status in childhood increased the likelihood of internalizing symptoms in adulthood (Modin et al., 2011). Taken together, studies support both directions of the transactional relationship between social anxiety and social status.

## **Specific links between popularity, likeability, FNE, and SAD**

When investigating the longitudinal link between social anxiety and status, it is important to distinguish between popularity, likeability, FNE, and SAD, because these factors may differentially relate to each other.

### ***Popularity versus likeability***

The transactional relation with social anxiety may be stronger for popularity than for likeability. First, social anxiety might be a stronger predictor of popularity than likeability. This is explained by the fact that socially anxious individuals over-utilize the social rank system: they hierarchically perceive the world and view relationships as more competitive than non-anxious individuals. They consider themselves inferior to their peers and as unable to compete directly with high-status peers. Instead, they try to avoid harm, rejection, or being passed over by behaving in a subordinate and avoidant way (Aderka et al., 2009; Gilbert & Trower, 2001). Consequently, socially anxious adolescents acquire a low position in the hierarchy (low popularity). Contrary, the appeasement and socially desirable behaviour of socially anxious individuals (Catarino et al., 2014; Gilbert, 2014), may not impinge on peers or affect the capability to initiate and maintain friendships (Rodebaugh et al., 2015; Rose et al., 2011), resulting in a neutral likeability status (Sandstrom & Cillessen, 2006). Indeed, social anxiety was negatively associated with peer evaluations about dominance (popularity) but not with affiliative peer evaluations (likeability) (Dijk et al., 2018). Similarly, socially anxious individuals believe that they are less liked by others but in reality are not less liked (Christensen et al., 2003; Voncken et al., 2020), and in fact are often even more liked than non-anxious individuals (Baartmans et al., 2019).

Second, popularity could have a stronger effect than likeability on social anxiety as unpopularity may be more socially threatening than being disliked. Unpopularity was more strongly related to victimization and withdrawal than being disliked by



peers. Also, unpopularity was associated with loneliness and having few friends, while disliking was not (Hopmeyer Gorman et al., 2011). Having a reciprocated friend serves as a protective factor for developing social anxiety (la Greca & Harrison, 2005), and the lack of friendships may cause unpopular youth to be at risk for ostracism and victimization (Schmidt & Bagwell, 2007). These studies imply that low popularity may increase social anxiety more than low likeability.

### ***SAD versus FNE***

It can be assumed that the transactional relationship of social status with social avoidance and distress is stronger than its transactional relation with fear of negative evaluation. First, the effects of SAD on prospective levels of social status may be stronger than the effects of FNE on status. Experienced social avoidance and distress during peer interactions may be better observable by peers than the mere fear of negative evaluation, probably making the impact of SAD on status more direct, and therefore stronger, than the impact of FNE. Avoidance may limit socialization opportunities, resulting in social skills deficits (Greco & Morris, 2005) or interaction problems (Clark & Wells, 1995), which may lower one's peer status. Similarly, by showing distress, peers may view adolescents as less attractive interaction partners, which may increase the risk of being negatively viewed by peers and obtaining a low status (Alden & Taylor, 2004; Dodge & Feldman, 1990).

Second, the opposite direction of the effect (status to social anxiety) may also be stronger for SAD than FNE. According to the sociometer theory (Leary & Baumeister, 2000), people monitor their social environment looking for potential threats. When peer relationships are in danger, individuals are internally warned, causing them to take necessary actions (Wong et al., 2014). Similarly, evolutionary models suggest that avoidance, submissive behaviour, and showing distress are part of self-protective mechanisms (Gilbert, 2014). When faced with a social threat (e.g., low status), individuals may automatically react with SAD, while more conscious cognitive symptoms including FNE may not immediately be elevated.

Though longitudinal evidence for both directions is missing, cross-sectional research found that adolescents who show avoidance and withdrawal from peer interactions are perceived by peers as unpopular and disliked (Pouwels et al., 2016). Similarly, there are two subsets of anxious youth: those with and without peer difficulties. Both groups show negative cognitive appraisals but are distinguished by their behavioural

deficits (Flanagan et al., 2008). Showing SAD may impact a lower status to a greater extent than FNE per se. Moreover, low popular girls show more submissive behaviour during interactions (Lansu & Cillessen, 2015), and low peer acceptance is more strongly associated with SAD than with FNE (la Greca & Lopez, 1998).

## Current study

In sum, theories and studies indicate that status and social anxiety become increasingly important during early adolescence and are reciprocally related. Controversially, many youth experience poor peer relations without being socially anxious, while there are also socially anxious youths who do not encounter peer problems (Crick & Ladd, 1993; Flanagan et al., 2008). This unclear or distorted image may have resulted from the fact that status and social anxiety so far have been investigated as general constructs, without distinguishing the conceptually different subcomponents. To investigate how these subcomponents influence each other and in which direction, this 6-month-longitudinal study aimed to examine the transactional relationship between social status (i.e., likeability and popularity) and social anxiety symptoms (i.e., fear of negative evaluation [FNE] and social avoidance and distress [SAD]) in early adolescence.

In line with the transactional model, we expected that social status and social anxiety would affect each other over time in a negative reciprocal way. We hypothesized that the strength of the associations varied between the status and anxiety components. Social avoidance and distress would be more strongly related to social status than fear of negative evaluation. Associations with social anxiety symptoms were expected to be more apparent for popularity than likeability. Moreover, inconclusive evidence suggests that the relations between status and social anxiety may be different for boys and girls. Some studies found that the relationship is stronger for boys (Flanagan et al., 2008; Storch et al., 2005) or girls (la Greca & Lopez, 1998; Modin et al., 2011), while others found no gender differences (la Greca & Harrison, 2005). Another study found that social anxiety could be predicted by popularity in boys but by likeability in girls (Sandstrom & Cillessen, 2006). Therefore, gender effects were explored, without specific hypotheses.

By focusing on the subcomponents, this study contributed to a more detailed understanding of the relationship between status and social anxiety in early adolescents. This may be fruitful in developing more effective individualized

prevention and treatment programs for socially anxious or low-status youth. For instance, particularly for youth showing SAD (rather than only experiencing FNE), it may be necessary to target problematic peer relationships directly via social skills training. Similarly, unpopular youth may benefit more from social anxiety prevention than youth who are disliked by peers.

## METHODS

### Sample

This study was part of a longitudinal study regarding bullying and psychosocial functioning in adolescence (Pouwels et al., 2018). The study consisted of two waves with a 6-month interval (October 2014 and March 2015). 275 adolescents from 12 classrooms in grades 7 and 8 of a secondary school in the South-Eastern part of The Netherlands participated (range<sub>classroom size</sub> = 16-30 students,  $SD = 4.47$ ). One participant was absent during both waves and excluded, 9 were absent at wave 1 (3.3%) and 11 at wave 2 (4.4%). In wave 1, 3 participants did not finish the questionnaires (1.1%), resulting in partly missing data (information about social anxiety was missing, social status was known). At wave 2, all participating adolescents had complete data. Data were missing completely at random and automatically replaced in our longitudinal analyses (see results for details).

The final sample consisted of 274 adolescents (136 boys, 49.6%). Adolescents were between 11 and 14 years old at wave 1 ( $M_{age} = 12.55$ ,  $SD = 0.62$ ). The majority was of Dutch origin (89.1%), while others were from Morocco (0.4%), Turkey (0.4%), Dutch Antilles or Aruba (0.7%), Suriname (0.4%), another European country (2.2%), or another non-European country (3.6%). The ethnicity of participants absent in wave 1 was unknown (3.3%). Regarding educational level, 35.8% was in pre-vocational (in Dutch: VMBO-HAVO) and 64.2% was in pre-college education (in Dutch: HAVO-VWO).

### Measures

#### ***Social status***

Computerized sociometry was used to measure popularity and likeability. Four questions assessed who was liked, disliked (*“Who of your classmates do you like most/least?”*), popular, and unpopular (*“Who of your classmates are most/least popular?”*). For each question, adolescents nominated one up to an unlimited number of classmates. Same-sex and other-sex nominations were permitted but

self-nominations were not. The number of nominations received per question was counted and standardized within classrooms to control for differences in classroom size. Measures of likeability and popularity were computed by calculating the difference scores of the standardized number of nominations for most liked/popular minus least liked/popular, respectively (Coie et al., 1982). Sociometry is reliable and valid, with high internal consistency (van den Berg & Cillessen, 2013).

### **Social anxiety**

A shortened Dutch version of the Social Anxiety Scale for Adolescents (SAS-A; la Greca & Lopez, 1998) measured social anxiety. The SAS-A consisted of different subscales. Four items of the Social Avoidance and Distress-General subscale (e.g., *"I'm quiet when I'm with a group of people"*), and four items of the Fear of Negative Evaluation subscale (e.g., *"I worry about what others think of me"*) were administered. Answer scales ranged from 1 = *"not at all"* to 5 = *"all the time"*. Two mean scores were computed for these subscales to investigate FNE and SAD. This version of the SAS-A is valid (Nelemans et al., 2019). Factor analyses of our study (contact the first author for details) and previous studies (la Greca & Lopez, 1998; Nelemans et al., 2019) supported a clear distinction between the subscales. The internal consistency in our study was good, Cronbach's  $\alpha$   $FNE_{w1} = .93$ ,  $FNE_{w2} = .94$ ,  $SAD_{w1} = .81$ ,  $SAD_{w2} = .84$ .

### **Procedure**

The school was recruited based on previous collaboration and teachers gave consent for participation in their classes. After obtaining passive consent of parents and active consent of adolescents (consent rate of 100%), data collection took place at school, during a one-hour classroom session. Researchers were present to provide instructions, answer questions, and assure confidentiality and anonymity. Adolescents completed the measures on netbooks. To prevent looking at each other's screens, desks were provided with partitioning screens. This procedure was approved by the Institutional Ethical Review Board.

## **RESULTS**

Descriptive statistics of popularity, likeability, FNE, and SAD are presented in Table 1. Pearson's correlations between status and social anxiety components

are shown in Table 2. We found high stability of popularity and likeability, and moderate stability of social anxiety symptoms. Popularity and likeability correlated significantly in both waves, as well as FNE and SAD.

We used Fisher's  $r$ -to- $z$  transformations and Steigers' equations with a two-tailed test (Lee & Preacher, 2013) to examine whether (1) correlations between social status and SAD were stronger than correlations between social status and FNE, and (2) correlations between popularity and social anxiety were stronger than correlations between likeability and social anxiety. At both waves, FNE and social status constructs did not significantly correlate. SAD was moderately and negatively related to popularity and likeability at both waves. Associations with social status were significantly stronger for SAD than for FNE (popularity<sub>wave1</sub>:  $z = 6.90, p < .001$ ; popularity<sub>wave2</sub>:  $z = 3.64, p < .001$ ; likeability<sub>wave1</sub>:  $z = 3.06, p = .002$ ; likeability<sub>wave2</sub>:  $z = 2.71, p = .007$ ). Thus, higher social avoidance and distress but not fear of negative evaluation was related to lower popularity and likeability. At wave 1, SAD was significantly more strongly associated with popularity than likeability ( $z = 2.97, p = .003$ ), and a comparable non-significant trend was found at wave 2 ( $z = 1.66, p = .096$ ). Thus, associations with social avoidance and distress were in general stronger for popularity than for likeability. No comparisons were made between FNE and status components because these correlations were non-significant.

**Table 1**

*Means, standard deviations, minimum and maximum scores of social status components, and social anxiety symptoms per wave*

|                          | Wave 1   |          |           |            |            | Wave 2   |          |           |            |            |
|--------------------------|----------|----------|-----------|------------|------------|----------|----------|-----------|------------|------------|
|                          | <i>N</i> | <i>M</i> | <i>SD</i> | <i>Min</i> | <i>Max</i> | <i>N</i> | <i>M</i> | <i>SD</i> | <i>Min</i> | <i>Max</i> |
| Raw nominations          |          |          |           |            |            |          |          |           |            |            |
| Least liked              | 274      | 1.65     | 2.63      | 0.00       | 17.00      | 274      | 1.45     | 2.23      | 0.00       | 12.00      |
| Most liked               | 274      | 2.92     | 2.05      | 0.00       | 9.00       | 274      | 2.31     | 1.60      | 0.00       | 8.00       |
| Least popular            | 274      | 3.56     | 5.48      | 0.00       | 24.00      | 274      | 3.23     | 5.56      | 0.00       | 28.00      |
| Most popular             | 274      | 4.22     | 5.35      | 0.00       | 26.00      | 274      | 3.99     | 5.29      | 0.00       | 22.00      |
| Main variables           |          |          |           |            |            |          |          |           |            |            |
| Popularity <sup>z</sup>  | 274      | 0.00     | 1.70      | -4.31      | 3.92       | 274      | 0.01     | 1.65      | -4.55      | 3.71       |
| Likeability <sup>z</sup> | 274      | 0.00     | 1.65      | -5.33      | 2.83       | 274      | 0.01     | 1.61      | -5.37      | 3.88       |
| FNE                      | 262      | 1.80     | 0.91      | 0.00       | 4.00       | 263      | 1.82     | 0.88      | 0.00       | 4.00       |
| SAD                      | 262      | 1.02     | 0.79      | 0.00       | 4.00       | 263      | 1.07     | 0.75      | 0.00       | 4.00       |

*Note.* <sup>z</sup> = standardized variable. FNE = Fear of negative evaluation. SAD = Social avoidance and distress. Sample size differs per variable and per wave due to missing data.

**Table 2**  
*Pearson's correlations between social status components and social anxiety symptoms for wave 1 (light grey), wave 2 (dark grey), and across waves (white) including autocorrelations (black)*

|               | Wave 1     |                   |                 |                    | Wave 2             |                   |                   |                    |
|---------------|------------|-------------------|-----------------|--------------------|--------------------|-------------------|-------------------|--------------------|
|               | Popularity | Likeability       | FNE             | SAD                | Popularity         | Likeability       | FNE               | SAD                |
| <b>Wave 1</b> |            |                   |                 |                    |                    |                   |                   |                    |
| Popularity    | --         | .50***<br>N = 274 | -.03<br>N = 262 | -.42***<br>N = 262 | .89***<br>N = 274  | .32***<br>N = 274 | .04<br>N = 263    | -.28***<br>N = 263 |
| Likeability   |            | --                | -.07<br>N = 262 | -.25***<br>N = 262 | .45***<br>N = 274  | .62***<br>N = 274 | .02<br>N = 263    | -.24***<br>N = 263 |
| FNE           |            |                   | --              | .53***<br>N = 262  | -.11<br>N = 262    | -.05<br>N = 262   | .45***<br>N = 251 | .19**<br>N = 251   |
| SAD           |            |                   |                 | --                 | -.44***<br>N = 262 | -.13*<br>N = 262  | .23***<br>N = 251 | .46***<br>N = 251  |
| <b>Wave 2</b> |            |                   |                 |                    |                    |                   |                   |                    |
| Popularity    |            |                   |                 |                    | --                 | .37***<br>N = 274 | -.07<br>N = 263   | -.32***<br>N = 263 |
| Likeability   |            |                   |                 |                    |                    | --                | -.02<br>N = 263   | -.21**<br>N = 263  |
| FNE           |            |                   |                 |                    |                    |                   | --                | .34***<br>N = 263  |
| SAD           |            |                   |                 |                    |                    |                   |                   | --                 |

Note. FNE = Fear of negative evaluation. SAD = Social avoidance and distress. Sample size differs per correlation due to missing data.  
 \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

## Longitudinal associations

Linear regression assumptions were met. Autoregressive cross-lagged panel models were computed in Mplus 7.3 (Muthén & Muthén, 2012). Missing data (see methods for details) were automatically replaced using full maximum likelihood estimation. Good model fit was concluded if the chi-square test was non-significant, CFI > 0.95, RMSEA < 0.06, and SRMR < 0.08 (Hu & Bentler, 1999). Lower Akaike Information Criterion (AIC) values indicated a better fit. Change in fit between models was examined using a chi-square difference test and evaluated as substantial if  $\Delta\text{CFI} \geq -0.010$ ,  $\Delta\text{RMSEA} \geq 0.015$ , and  $\Delta\text{SRMR} \geq 0.010$  (Chen, 2007). Table 3 presents the model fit indices and comparison statistics.

Model 1 was the basic model and tested whether our hypothesized model fitted the data of the total sample. Model 1 included popularity, likeability, FNE, and SAD at wave 1 as independent variables and at wave 2 as dependent variables. Autoregressive paths for all variables from wave 1 to wave 2 were included to control for stability. Model 1 also contained the cross-lagged paths from popularity and likeability at wave 1 to FNE and SAD at wave 2 and the opposite cross-lagged paths. Concurrent associations between all variables at both waves were included to be controlled for. Model 1 had a good model fit, indicating that our conceptual model fitted the data.

To test for gender differences in our conceptual model, we used the procedure of multiple group comparisons. Model 2 was a fully unconstrained model in which all paths of Model 1 were estimated freely for boys and girls. The model fit of this model was good. In Model 3, all paths were constrained to be equal across gender (fully constrained model). Chi-square criteria showed bad model fit but CFI, RMSEA, and SRMR indicated good model fit. The model fit of Model 3 was significantly and substantially worse than the unconstrained Model 2,  $\Delta\chi^2(24) = 43.66$ ,  $p = .008$ ,  $\Delta\text{CFI} = -0.021$ ,  $\Delta\text{RMSEA} = 0.059$ ,  $\Delta\text{SRMR} = 0.050$ , pointing at gender differences.

To test which paths were different for boys and girls, we conducted Wald  $\chi^2$  tests for each path. Two paths were moderated by gender: (1) the cross-lagged path from popularity at wave 1 to SAD at wave 2 (Wald  $\chi^2(1) = 7.34$ ,  $p = .007$ ) and (2) the correlation between FNE and SAD at wave 2 (Wald  $\chi^2(1) = 10.38$ ,  $p = .001$ ). In Model 4, these paths were unconstrained across gender, while all parameters that did not significantly differ between boys and girls were constrained to be equal. Model 4 had a good fit and releasing these paths improved the fit of the fully constrained (i.e., Model 3) model significantly and substantially ( $\Delta\chi^2(2) = 21.24$ ,  $p < .001$ ,  $\Delta\text{CFI} = -0.021$ ,

$\Delta\text{RMSEA} = 0.059$ ,  $\Delta\text{SRMR} = 0.022$ ). No significant differences in model fit were found between Model 4 and the fully unconstrained Model 2 ( $\Delta\chi^2(22) = 22.42$ ,  $p = .435$ ,  $\Delta\text{CFI} = 0.000$ ,  $\Delta\text{RMSEA} = 0.000$ ,  $\Delta\text{SRMR} = 0.028$ ). We selected Model 4 as our final Model, given that it was the most parsimonious model and had the lowest AIC of all models.

The significant coefficients of Model 4 are presented in Figure 1, and Table 4 shows all parameter estimates. All autoregressive paths were significant,  $ps < .001$ , and were not different for boys and girls. Higher popularity, likeability, FNE, and SAD at wave 1 predicted higher levels at wave 2. This stability was strong for likeability ( $\beta_{\text{boys}} = .64$ ;  $\beta_{\text{girls}} = .58$ ), and popularity ( $\beta_{\text{boys}} = .85$ ;  $\beta_{\text{girls}} = .87$ ), and moderate for FNE ( $\beta_{\text{boys}} = .43$ ;  $\beta_{\text{girls}} = .43$ ), and SAD ( $\beta_{\text{boys}} = .40$ ;  $\beta_{\text{girls}} = .40$ ). Most cross-lagged paths were non-significant and did not differ between boys and girls. An exception was the path from popularity to SAD. Only among girls, popularity at wave 1 negatively predicted SAD at wave 2,  $\beta = -.26$ ,  $p = .001$ . Girls who were seen as less popular by peers reported more social avoidance and experienced more distress in social situations 6 months later. Most concurrent paths were equal for boys and girls, except for the relation between FNE and SAD at wave 2. This association was positive and moderately strong for boys ( $\beta_{\text{boys}} = .52$ ,  $p < .001$ ) but marginally significant for girls ( $\beta_{\text{girls}} = .16$ ,  $p = .054$ ). For an interpretation of concurrent associations, we would like to refer to the Pearson correlations. The model explained the variance quite differently for each construct at wave 2: FNE  $R^2 = .19$  for boys and girls; SAD  $R^2_{\text{boys}} = .16$ ,  $R^2_{\text{girls}} = .36$ ; likeability  $R^2_{\text{boys}} = .41$ ,  $R^2_{\text{girls}} = .33$ ; and popularity  $R^2_{\text{boys}} = .77$ ,  $R^2_{\text{girls}} = .82$ .

**Table 3**  
*Model fit indices and model comparisons of Models 1-4*

| Model                  | $\chi^2$       | df          | p     | CFI                | RMSEA                | SRMR                | AIC                |
|------------------------|----------------|-------------|-------|--------------------|----------------------|---------------------|--------------------|
| 1: Total sample        | 1.70           | 4           | .791  | 1.000              | 0.000                | 0.009               | 5892.83            |
| 2: Fully unconstrained | 3.70           | 8           | .883  | 1.000              | 0.000                | 0.014               | 5863.81            |
| 3: Fully constrained   | 47.36          | 32          | .039  | 0.979              | 0.059                | 0.064               | 5859.46            |
| 4: Final <sup>a</sup>  | 26.12          | 30          | .669  | 1.000              | 0.000                | 0.042               | 5842.22            |
| Comparisons            | $\Delta\chi^2$ | $\Delta df$ | p     | $\Delta\text{CFI}$ | $\Delta\text{RMSEA}$ | $\Delta\text{SRMR}$ | $\Delta\text{AIC}$ |
| 2 - 3                  | 43.66          | 24          | .008  | -0.021             | 0.059                | 0.050               | -4.35              |
| 3 - 4                  | 21.24          | 2           | <.001 | -0.021             | 0.059                | 0.022               | 17.24              |
| 2 - 4                  | 22.42          | 22          | .435  | 0.000              | 0.000                | 0.028               | -21.59             |

*Note.* CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion. Each model had sufficient power according to the rule of thumb that for each parameter you need at least 5 observations (Little, 2013). <sup>a</sup> = In the final model, two paths are unconstrained for boys and girls: 1) the path from popularity wave 1 to SAD wave 2 and 2) the correlation between FNE and SAD wave 2. All other paths are constrained across gender.

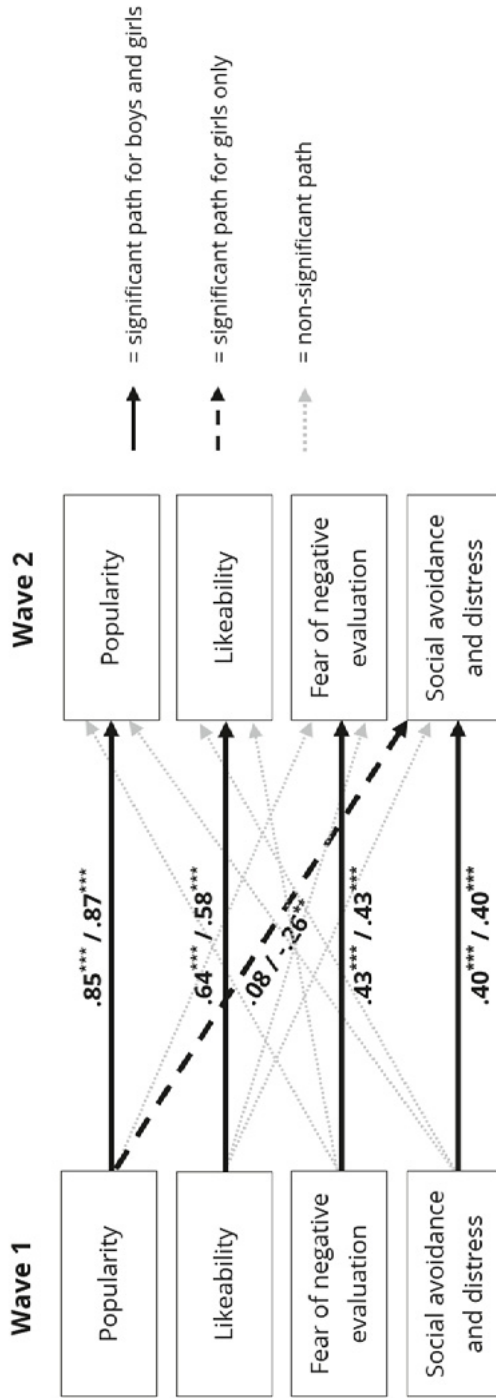


**Table 4**  
*Parameter estimates of Model 4 for boys and girls*

|   | Boys ( <i>n</i> = 136) |                        |            | Girls ( <i>n</i> = 138) |                        |             |
|---|------------------------|------------------------|------------|-------------------------|------------------------|-------------|
|   | <i>B</i>               | <i>B</i> <sub>SE</sub> | $\beta$    | <i>B</i>                | <i>B</i> <sub>SE</sub> | $\beta$     |
| Autoregressive effects                                |                        |                        |            |                         |                        |             |
| Popularity <sub>W1</sub> → Popularity <sub>W2</sub>   | 0.84***                | 0.03                   | .85        | 0.84***                 | 0.03                   | .87         |
| Likeability <sub>W1</sub> → Likeability <sub>W2</sub> | 0.60***                | 0.05                   | .64        | 0.60***                 | 0.05                   | .58         |
| FNE <sub>W1</sub> → FNE <sub>W2</sub>                 | 0.41***                | 0.05                   | .43        | 0.41***                 | 0.05                   | .43         |
| SAD <sub>W1</sub> → SAD <sub>W2</sub>                 | 0.37***                | 0.05                   | .40        | 0.37***                 | 0.05                   | .40         |
| Cross-lagged effects                                  |                        |                        |            |                         |                        |             |
| Popularity <sub>W1</sub> → FNE <sub>W2</sub>          | 0.03                   | 0.03                   | .05        | 0.03                    | 0.03                   | .05         |
| Likeability <sub>W1</sub> → FNE <sub>W2</sub>         | 0.01                   | 0.03                   | .02        | 0.01                    | 0.03                   | .01         |
| <b>Popularity<sub>W1</sub> → SAD<sub>W2</sub></b>     | <b>0.03</b>            | <b>0.04</b>            | <b>.08</b> | <b>-0.12**</b>          | <b>0.04</b>            | <b>-.26</b> |
| Likeability <sub>W1</sub> → SAD <sub>W2</sub>         | -0.04                  | 0.03                   | -.10       | -0.04                   | 0.03                   | -.09        |
| FNE <sub>W1</sub> → Popularity <sub>W2</sub>          | -0.07                  | 0.06                   | -.03       | -0.07                   | 0.06                   | -.04        |
| SAD <sub>W1</sub> → Popularity <sub>W2</sub>          | -0.12                  | 0.08                   | -.05       | -0.12                   | 0.08                   | -.06        |
| FNE <sub>W1</sub> → Likeability <sub>W2</sub>         | -0.08                  | 0.10                   | -.04       | -0.08                   | 0.10                   | -.04        |
| SAD <sub>W1</sub> → Likeability <sub>W2</sub>         | 0.09                   | 0.12                   | .05        | 0.09                    | 0.12                   | .05         |
| Concurrent effects                                    |                        |                        |            |                         |                        |             |
| Popularity <sub>W1</sub> ⇌ Likeability <sub>W1</sub>  | 1.34***                | 0.19                   | .45        | 1.34***                 | 0.19                   | .54         |
| Popularity <sub>W1</sub> ⇌ FNE <sub>W1</sub>          | -0.06                  | 0.09                   | -.04       | -0.06                   | 0.09                   | -.04        |
| Popularity <sub>W1</sub> ⇌ SAD <sub>W1</sub>          | -0.58***               | 0.09                   | -.41       | -0.58***                | 0.09                   | -.45        |
| Likeability <sub>W1</sub> ⇌ FNE <sub>W1</sub>         | -0.19*                 | 0.09                   | -.13       | -0.19*                  | 0.09                   | -.15        |
| Likeability <sub>W1</sub> ⇌ SAD <sub>W1</sub>         | -0.35***               | 0.08                   | -.26       | -0.35***                | 0.08                   | -.30        |
| FNE <sub>W1</sub> ⇌ SAD <sub>W1</sub>                 | 0.38***                | 0.05                   | .53        | 0.38***                 | 0.05                   | .55         |
| Popularity <sub>W2</sub> ⇌ Likeability <sub>W2</sub>  | 0.21***                | 0.06                   | .21        | 0.21***                 | 0.06                   | .24         |
| Popularity <sub>W2</sub> ⇌ FNE <sub>W2</sub>          | -0.08*                 | 0.03                   | -.13       | -0.08*                  | 0.03                   | -.16        |
| Popularity <sub>W2</sub> ⇌ SAD <sub>W2</sub>          | -0.05                  | 0.03                   | -.08       | -0.05                   | 0.03                   | -.12        |
| Likeability <sub>W2</sub> ⇌ FNE <sub>W2</sub>         | -0.06                  | 0.06                   | -.07       | -0.06                   | 0.06                   | -.07        |
| Likeability <sub>W2</sub> ⇌ SAD <sub>W2</sub>         | -0.08                  | 0.05                   | -.09       | -0.08                   | 0.05                   | -.10        |
| <b>FNE<sub>W2</sub> ⇌ SAD<sub>W2</sub></b>            | <b>0.28***</b>         | <b>0.05</b>            | <b>.52</b> | <b>0.07</b>             | <b>0.04</b>            | <b>.16</b>  |

Note. FNE = Fear of negative evaluation. SAD = Social avoidance and distress. Regression paths that are printed in bold, differed significantly between boys and girls. Standardized regression coefficients could differ between boys and girls because variances were not constrained across gender. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

**Figure 1**  
 Graphic representation of longitudinal standardized estimates of Model 4 for boys (left coefficients) and girls (right coefficients)



Note. Although not depicted in this figure, the model also controlled for concurrent correlations between the variables. All correlations were equal across gender, except for the association between FNE and SAD at wave 2. This association was moderately positive for boys ( $\beta = .52, p < .001$ ) but marginally significant for girls, ( $\beta = .16, p = .054$ ).  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

## DISCUSSION

This study examined the transactional longitudinal associations of social status components (likeability and popularity) and social anxiety symptoms (fear of negative evaluation and social avoidance and distress) across 6 months in early adolescence. We explored gender differences in these associations.

Concurrent associations between social anxiety and status pointed to a negative association in general but we found that this relation depends upon the type of social anxiety symptoms. Higher social avoidance and distress was related to being less popular and less liked, whereas fear of negative evaluation was not. This could be explained by socially anxious behaviours and distress during social situations being more visible to peers than subjective fears of negative evaluation. By avoiding situations, socialization opportunities may be limited, potentially resulting in social skills deficits (Greco & Morris, 2005) and interaction problems (Clark & Wells, 1995), which may unfold into lower levels of popularity (Alden & Taylor, 2004; Dodge & Feldman, 1990). Social avoidance and distress was more strongly related to popularity than to likeability. This is also in line with previous research and theories implying that social anxiety is more related to problems with dominance and social hierarchies (popularity) than to affiliative relationships (likeability; Gilbert & Trower, 2001; Gilboa-Schechtman et al., 2013). Being disliked may be less socially threatening than being unpopular, as unpopularity is more strongly related to ostracism and a lack of friendships (Hopmeyer Gorman et al., 2011). Caution is warranted with these explanations since our longitudinal analyses did not support all correlational findings.

Further, we examined the prospective associations between social status and social anxiety. In line with the transactional model (Morris, 2001; Ollendick & Hirshfeld-Becker, 2002), we expected that socially anxious individuals would have a lower peer status over time, and low-status adolescents would experience increasing social anxiety. We found no support for such a transactional relationship. In line with the interpersonal risk model, we only found some support for the effects of social status on social anxiety. In contrast to the symptoms-driven model, we found no support for the opposite effect of social anxiety on status.

### **Social anxiety predicting social status**

The stability of likeability and popularity was very high across the two waves. This was similar to previous studies (Lu Jiang & Cillessen, 2005) and may be due to both

waves taking place within one academic year. The classroom context remained the same, so big shifts in social status were unlikely. The symptoms-driven model suggests that socially anxious individuals may cause peer problems that may result in low status, due to their social deficits, internalizing behavioural styles, or self-selection of maladaptive relationships (Kochel et al., 2012). However, this idea was not supported by our findings, as neither self-reported fear of negative evaluation nor social avoidance and distress were able to predict adolescents' peer status. The absence of this relation could perhaps be explained by the high stability of peer status.

A theoretical explanation for the stability of status and the non-significant effects might be that social anxiety is important in establishing status at the beginning of the school year but less so throughout the year. This can be explained by the concept of 'reputational bias' (Hymel et al., 1990): once adolescents obtained a reputation in the group, peers are inclined to continue to perceive them in this role, unlikely to adjust their view, even when adolescents' behaviour changes. Possibly, socially anxious adolescents are quickly seen by their peers as less popular and liked than non-anxious adolescents. Becoming less socially anxious later in the year, no longer affect their status, as their low-status reputation is already formed. To test this, we need more measurements at the beginning of the school year to investigate status formation in classrooms.

### **Social status predicting social anxiety**

The stability of social anxiety symptoms was less strong than social status and allowed for prediction by social status. Our results show some support for the interpersonal risk model suggesting that social anxiety arises in an environment when relationships are conflicting and unsupportive due to interference with the basic human need to belong and need for support (Kochel et al., 2012; Sentse et al., 2017). For girls but not for boys, being less popular preceded higher social avoidance and distress. The result that low popularity (instead of low likeability) predicts social avoidance and distress is in line with studies arguing that unpopularity may be more socially stressful than disliking by peers. Low popularity was more strongly related to victimization, ostracism, and a lack of friendships than low likeability, thereby increasing the risk for social anxiety (Hopmeyer Gorman et al., 2011).

Similarly, our finding that low popular girls did develop more social avoidance and distress but did not increase in fear of negative evaluation was in line with our expectations. The sociometer theory (Leary & Baumeister, 2000) and evolutionary models (Gilbert, 2014) argue that SAD is part of automatic self-protective mechanisms, while FNE is not. In fact, social avoidance might be adaptive in uncontrollable settings and even reduces social anxiety feelings such as FNE in the short term due to experienced control over the situation (Hofmann & Hay, 2018). Thus, showing more SAD can be a safety strategy for less popular girls to avoid the risk to be victimized (Zimmer-Gembeck et al., 2014). However, SAD is more detrimental in the long-term: SAD can maintain or increase social anxiety (Hofmann & Hay, 2018) or lead to more problematic peer relationships as peers might judge the adolescents on these anxiety-related signs. Future research could investigate whether low popularity also predicts an increase in FNE across a larger time interval. Our finding has some implications for prevention and treatment: for low popular girls, it might be good to train relaxation skills and target safety avoidance behaviours in social situations particularly. This may prevent more detrimental consequences of avoidance and distress, such as social exclusion and victimization.

On the one hand, the longitudinal gender difference corresponds with research showing that low-status girls but not boys, were at higher risk of developing internalizing problems in adulthood (Modin et al., 2011). Also, it is in line with cross-sectional research that shows that for girls, social anxiety was more strongly related to social functioning (la Greca & Lopez, 1998) and that specifically popularity was associated with social anxiety related behaviours (shyness, playing alone; Lease et al., 2002). On the other hand, the effect for girls is in contrast to research showing that popularity only predicted anxiety among boys (Sandstrom & Cillessen, 2006). However, compared to our study, they used a relatively large time span of 3 years (instead of 6 months) and focused on more general feelings of anxiety (instead of on social anxiety specifically) which might explain the different findings (Keijsers & van Roekel, 2018). The gender difference could be explained by the self-construal theory (Cross et al., 2011) suggesting that girls' sense of self is more interdependent as it is derived from relationships to a greater extent than boys' identity. Girls are more reactive to peer relationships, and they may therefore also experience more anxiety in response to low popularity than boys (Asher et al., 2017).

## **Strengths, limitations, and future directions**

This study provided a more fine-grained examination of the longitudinal link between social status and social anxiety by differentiating between subcomponents (popularity, likeability, fear of negative evaluation, and social avoidance and distress). Another strength of this study is the use of peer reports to assess social status. Previous studies mostly used self-reports which might be problematic as socially anxious individuals have a biased perception of their social capacities and status (Baartmans et al., 2019; Miers et al., 2011). Previous findings might reflect underestimations of social status by socially anxious adolescents themselves instead of actual social status perceptions of their peers (Klein, Houtkamp, et al., 2018; Miers et al., 2011).

However, this study has some limitations. First, we only included two waves with a short-term interval of 6 months. Social status was quite stable during this period. Future research could include larger time intervals to investigate how social anxiety and social status develop across the secondary school when adolescents switch classes. Second, due to power issues, we did not make a distinction between the 7<sup>th</sup> and 8<sup>th</sup> grades. However, in the 7<sup>th</sup>-grade adolescents experienced a transition from primary to secondary school and entered a new peer context, while this was not the case in the 8<sup>th</sup> grade. This may have influenced the results because studies indicated that social anxiety especially increases after educational transitions (Grills-Taquechel et al., 2010). Including multiple waves during the first months of secondary school helps to understand how social status hierarchies are established in new peer contexts and how this relates to social anxiety. Third, autoregressive cross-lagged models could not distinguish within- and between-person effects (Berry & Willoughby, 2017; Hamaker et al., 2015). Future research with multiple waves should benefit from analyses that are able to do so (e.g., random intercepts cross-lagged panel models).

## **Conclusion**

This study investigated the transactional associations between distinct aspects of social status and social anxiety in early adolescence. Social status and social anxiety remained relatively stable over time. We found no support for a transactional relationship between social anxiety and status, nor for the symptoms-driven model as social anxiety was not related to prospective levels of peer status.

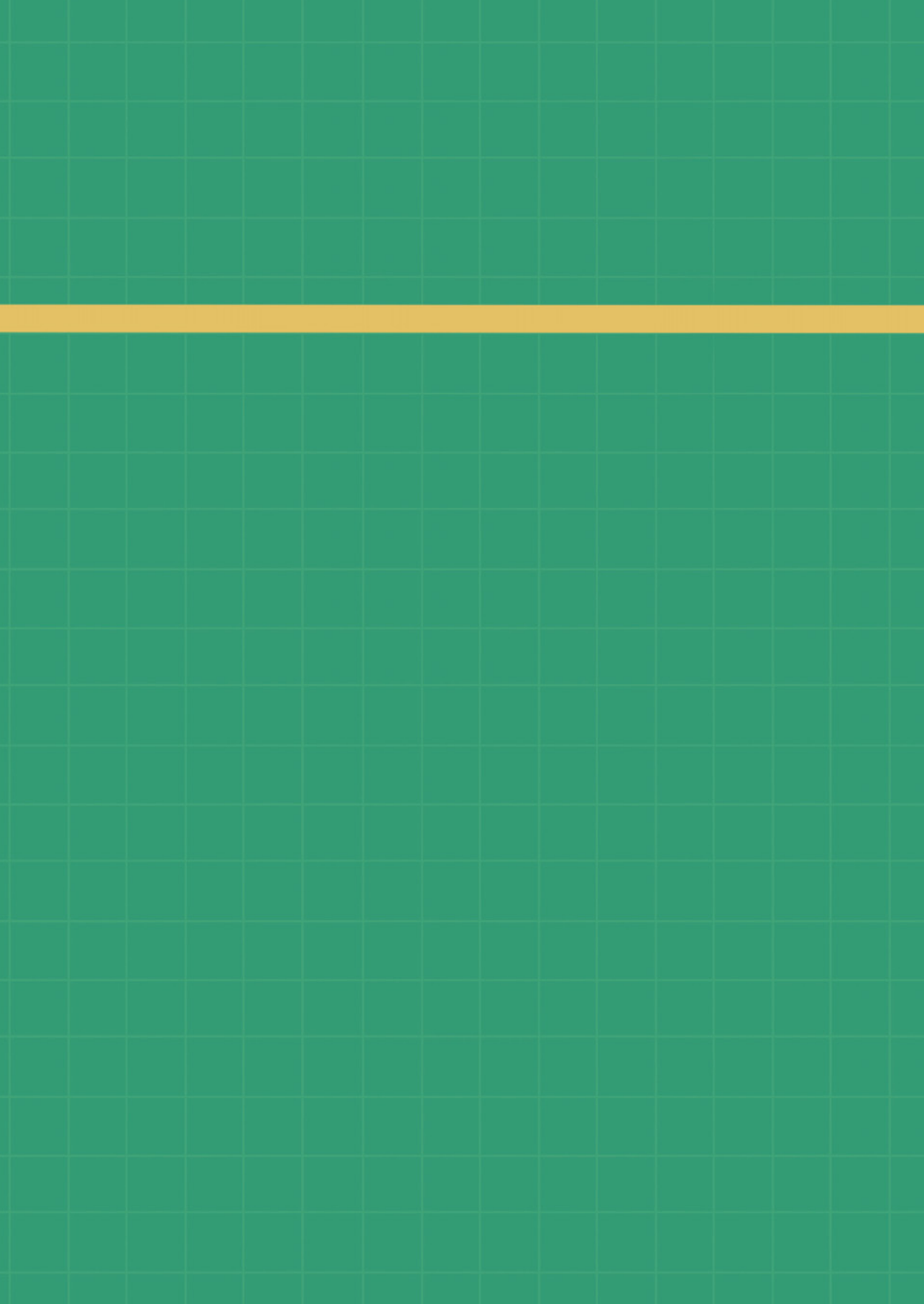
Instead, we found partial support for the interpersonal risk framework, as among girls being less popular predicted more social avoidance and distress. As expected, popularity did not predict fear of negative evaluation. These findings stress the importance of disentangling different social status and social anxiety components when examining their temporal interplay among boys and girls.

## **ACKNOWLEDGEMENTS**

Author Anke M. Klein was funded by a Niels Stensen Fellowship. We are grateful to the parents, teachers, and school administrators who made this research possible. Also thanks to all the research assistants who helped with the data collection. Special thanks to William Burk for his statistical advice.







# Chapter 5

## The longitudinal link between popularity, likeability, fear of negative evaluation and social avoidance across adolescence

## **ABSTRACT**

This study investigated the longitudinal bidirectional associations between likeability, popularity, fear of negative evaluation and social avoidance, to aid in preventing the negative consequences and persistent trajectories of low social status and heightened social anxiety. In total, 1741 adolescents in grade 7 to 9 participated at three yearly waves. A self-report questionnaire measured fear of negative evaluation. Peer nominations assessed likeability, popularity, and social avoidance. Lower popularity predicted more avoidance, and vice versa. More avoidance was related to lower likeability over time. Being less popular and/or more liked by peers, increased fear of negative evaluation. Support for a transactional model between social anxiety and social status was found. Distinguishing different social status and social anxiety components is important.

**Keywords:** social status; social anxiety; adolescence

## INTRODUCTION

Feelings of social anxiety increase during adolescence (Mancini et al., 2005), and social anxiety disorder (SAD; American Psychiatric Association, 2013; Wong et al., 2014) is actually one of the most common psychological disorders among adolescents (Jefferies & Ungar, 2020; Mesa et al., 2011). Fear of negative evaluation is the core fear of social anxiety, and individuals with social anxiety also show behavioural symptoms, such as fear-driven social avoidance (American Psychiatric Association, 2013)<sup>9</sup>. Not only social anxiety plays a central role in adolescence, around the same developmental time, youth become more aware of social hierarchies and strive to obtain and maintain a high social status among peers (LaFontana & Cillessen, 2010; Pellegrini & Long, 2002). Social status can be divided into several components with two of them being likeability, indicating how much an adolescent is liked by their peers; and popularity, indicating how dominant or social visible an adolescent is within the peer group (van den Berg et al., 2020). Heightened social anxiety symptoms and low status can have detrimental consequences, such as victimization, feelings of loneliness, and depressive symptoms (de Bruyn et al., 2010; Erath et al., 2007; Kraines et al., 2019; Maes et al., 2019; Siegel et al., 2009; Storch et al., 2005). In addition, both social status and social anxiety follow a chronic and unremitting course through adolescence (Hudson et al., 2015; Lu Jiang & Cillessen, 2005; Marks et al., 2012). The current study aims to obtain a better understanding of the development and maintenance of social anxiety and social status. This could aid in preventing the negative consequences and persistent trajectories of low social status and heightened social anxiety.

The transactional model posits that social status and social anxiety are bidirectionally related to each other during adolescence. They operate in a cyclic process, continuously influencing each other in both directions. Whereas several studies have demonstrated one direction of the relationship (social status predicting social anxiety, or vice versa; e.g., Biggs et al., 2010; van Zalk, van Zalk, & Kerr, 2011), there is only one longitudinal study examining both directions of the relationship in one model (Henricks et al., 2021). Furthermore, social status and social anxiety are broad

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<sup>9</sup> In the current study, social avoidance is assessed by asking peers who of their classmates does not say much or sits often alone. Although avoidance is related to social anxiety (Blöte et al., 2019), this item does not ask directly whether the social avoidance behaviour is fear-driven. Therefore, throughout the rest of the manuscript, we refer to fear of negative evaluation and social avoidance as 'social anxiety related constructs' instead of 'social anxiety symptoms'.

concepts, which can be subdivided into specific components and symptom types. Although research into social status distinguishes between popularity and likeability (e.g., Biggs et al., 2010; de Bruyn et al., 2010; Marks et al., 2012), social anxiety in relation to social status is often examined as an uniform construct (e.g., Biggs et al., 2010; van Zalk, van Zalk, Kerr, et al., 2011). At the same time, there are almost no studies investigating all four constructs in one study (except Henricks et al., 2021). This may have resulted in an unclear or distorted picture of the link between social status and social anxiety. To overcome these limitations, the current study examines the longitudinal transactional relationship between popularity, likeability, fear of negative evaluation and social avoidance during three yearly waves in adolescence.

### **Theoretical frameworks of social anxiety and social status**

Different theories regarding the association between social anxiety and social status as general constructs exist. On the one hand, the interpersonal risk model states that low social status may cause heightened social anxiety symptoms as problematic peer relationships are stressful (Kochel et al., 2012; Sentse et al., 2017). Contrary, the symptoms-driven model argues that socially anxious individuals may cause peer problems themselves due to their social deficits, self-selection of maladaptive friendships, or their behaviour, making them easy targets for victimization (Kochel et al., 2012). The transactional model combines both of these frameworks and suggests that social status and social anxiety are bidirectionally related and perpetuate each other (Kochel et al., 2012; Parker et al., 2005). Support for the transactional model has indirectly been found as different studies found empirical evidence for both the interpersonal risk as well as the symptoms-driven model. For instance, adolescents from low status crowds were found to experience an increase in social anxiety symptoms over time (van Zalk, van Zalk, & Kerr, 2011). Moreover, retrospective results showed that individuals with low likeability status in childhood were at considerably higher risk of an anxiety diagnosis thirty years later (Modin et al., 2011). At the same time, higher degree of social anxiety in adolescence predicted being less accepted by peers five months later, an indication of low social status (Biggs et al., 2010).

### **Subcomponents of social anxiety and social status**

The subcomponents of social status are quite distinct. There is only a low to moderate association between popularity and likeability with popular adolescents

not being necessarily liked, and well-liked adolescents not automatically being popular (van den Berg et al., 2020). Popularity and likeability also differentially relate to other behavioural constructs, suggesting that they are distinct. While popularity is positively associated with aggression, the association with aggression is negative for likeability (Cillessen & Marks, 2011). Similar to social status, social anxiety consists of different subcomponents: fear of negative evaluation and social avoidance. If individuals report increased fear during social interactions, this is not always observed in their behaviour (Cartwright-Hatton et al., 2005). At the same time, the different subcomponents may be differentially related to other constructs, suggesting that they are distinct from each other. For instance, while fear of negative evaluation is more related to depression and general anxiety (Inderbitzen-Nolan & Walters, 2000), social avoidance is more strongly related to poor friendship quality and friendship competency (la Greca & Lopez, 1998).

There are reasons to believe that the strength of the longitudinal link between social status and social anxiety varies for the two specific subcomponents of social status. For instance, research suggests that social anxiety is more strongly related to popularity than to likeability, as socially anxious individuals are particularly experiencing problems with popularity related aspects such as dominance, hierarchies, and social ranking (Aderka et al., 2009; Gilbert & Trower, 2001). Moreover, socially anxious individuals often try to appease others and show social desirable behaviour and may thus not necessarily be less liked (Catarino et al., 2014; Gilbert, 2014). Indeed, a study by Dijk et al. (2018) showed that social anxiety symptoms were negatively associated with popularity but not with likeability. Similarly, being unpopular may be more socially threatening as it more strongly relates to victimization, loneliness and having fewer friends, than being disliked (Hopmeyer Gorman et al., 2011).

The strength of the associations between social status and social anxiety may also vary for specific symptoms of social anxiety. Social avoidance might impact one's social status in a more profound way than social anxiety cognitions: behaviour is observable to peers and thoughts are not. When individuals tend to repeatedly avoid social situations, socialization opportunities become limited, which can lead to social skills deficits in the long run (Greco & Morris, 2005). Subsequently, others may judge withdrawn adolescents more negatively, resulting in a lower social status. Research supports this notion as less popular and less liked adolescents

showed higher levels of social avoidance (Pouwels et al., 2016). In addition, socially anxious individuals with behavioural deficits including social avoidance, more often experience peer difficulties such as victimization and low peer acceptance, while individuals who only suffer from socially anxious cognitions do not (Flanagan et al., 2008).

Given the different dimensions of social anxiety and social status and their potential transactional relationship over time, it is important to distinguish between the specific dimensions in order to obtain a detailed understanding of the link of social status and social anxiety in a longitudinal design. Although the studies described above already focused on subcomponents of social status or social anxiety (Dijk et al., 2018; Flanagan et al., 2008; Hopmeyer Gorman et al., 2011; Pouwels et al., 2016), longitudinal studies investigating both directions of all of these four components simultaneously and systematically during adolescence are lacking. Up until now there is only one recent publication by Henricks et al. (2021) investigating this. This study showed that different social anxiety symptom types were indeed differentially related to social status dimensions. Specifically, more social avoidance and distress was related to lower popularity and likeability, while higher fear of negative evaluation was not. The associations with social avoidance and distress were stronger for popularity than likeability. Longitudinal results of this study also showed that girls seen as less popular by their peers experienced more social avoidance and distress 6 months later, supporting the idea that especially popularity and social avoidance are linked.

Although the study by Henricks et al. (2021) was the first to empirically support the notion that different symptoms of social anxiety are uniquely and distinctively associated with the two dimensions of social status, there are two major limitations to this study. First, the associations between social status and social anxiety were examined within the same school year and within a relatively short interval of 6-months. This is especially problematic as both dimensions of social status are known to be highly stable within a school year (Lu Jiang & Cillessen, 2005; Rose et al., 2004), and so are levels of social fears (Ronchi et al., 2020; Tillfors et al., 2012). Social anxiety symptoms and social status are however less stable, when a one year interval is used (Lu Jiang & Cillessen, 2005; Ronchi et al., 2020). In the current study, we therefore expanded the developmental period under investigation by including three measurement waves with yearly intervals. As such, we are able

to examine how social anxiety symptoms and social status are interrelated from early to mid-adolescence.

A second limitation of the previous study was the operationalization of the social anxiety symptoms. Specifically, the study used one self-report questionnaire to assess cognitive and behavioural symptoms of social anxiety. However, the measure of behavioural symptoms has appeared to be less appropriate in retrospect as it did not only tap into the social avoidance (i.e., the behavioural component of social anxiety), but also the experienced stress during social situations, which entails more the cognitive and emotional side of social anxiety. Moreover, research showed that socially anxious adolescents may have a biased perception of their own behaviour and have the tendency to overestimate the frequency and severity of their social avoidance (Cartwright-Hatton et al., 2005; Miers et al., 2009). Using a self-report measure of social avoidance may thus result in overestimated levels. We will therefore use peer-reports for social avoidance and self-reports for fear of negative evaluation to get a reliable and valid estimation of the different components of social anxiety.

## **Gender differences**

The relationship between social status and social anxiety related constructs may be different for boys and girls. However, results on gender differences so far have been inconsistent. Two studies showed that the association between peer relations and social anxiety in early adolescence is stronger for boys (Flanagan et al., 2008; Storch et al., 2005). Contrary, other studies showed that social anxiety was more strongly linked to social functioning with peers in girls (la Greca & Lopez, 1998), and retrospective associations between a low likeability status and social anxiety diagnosis were merely found for women (Modin et al., 2011). There is also a study showing no gender differences between social status and social anxiety in adolescents (la Greca & Harrison, 2005). One other study found that social status is associated with social anxiety in boys and girls, but that the association differs for the two subcomponents of social status. More specifically, while popularity predicted social anxiety symptoms in boys, social anxiety in girls was predicted by their likeability status (Sandstrom & Cillessen, 2006). Finally, the previous study looking at the longitudinal associations between different subcomponents of social status and social status symptoms found that social avoidance and distress could predict popularity status only in girls



(Henricks et al., 2021). Based upon these mixed findings, the current study further explores gender differences when examining the longitudinal associations between popularity, likeability, fear of negative evaluation and social avoidance.

### **Current study**

To summarize, social status and social anxiety are assumed to be bidirectionally related to each other over time, but these associations may vary depending on the subcomponents under investigation. The aim of the current study was to examine the possibility of a bidirectional predictive relationship between social status (likeability and popularity) and social anxiety related constructs (fear of negative evaluation and social avoidance) during three yearly waves in adolescence. By doing so, this study could aid in preventing the negative consequences and persistent trajectories of low social status and heightened social anxiety. We expected social status and social anxiety related constructs to be reciprocally and negatively related to each other, yet that the strength of these associations would vary for the specific components of both status and anxiety. Specifically, we expected that lower popularity would more strongly predict higher social anxiety related constructs, than being less liked. Vice versa, higher levels of social anxiety related constructs would more strongly predict lower popularity than a lower likeability status. The longitudinal predictions with lower popularity and likeability status would be more apparent for social avoidance than for fear of negative evaluation. Finally, we will explore gender differences when examining the longitudinal associations between social status and social anxiety related constructs.

## **METHODS**

### **Sample**

The current study was part of the Kandinsky Longitudinal Study (KLS), a longitudinal study on detecting children at risk for social and emotional problems in a secondary school in the middle-eastern part of the Netherlands (van den Berg et al., 2019). The ongoing study started in 2010, with yearly assessments in November/December of all students in grades 7 through 10 (i.e. the first four years of secondary education in the Netherlands when adolescents are approximately 12-16 years old).

For the current study, we used data of the KLS collected between 2010 and 2014, as this was the period in which data concerning our variables of interests were

available. During these years, a total of 1785 adolescents participated. From these five years of data collection, we selected adolescents who were in grade 7 to 9 during these years and participated during at least one of these grades. Data from grade 10 were excluded because only a higher educated subsample participated during this grade<sup>10</sup>. This resulted in a final sample of 1741 adolescents (49.7% boys;  $N_{\text{grade7}} = 1375$ ;  $N_{\text{grade8}} = 1374$ ;  $N_{\text{grade9}} = 1129$ ). In grade 7, the age of the final sample ranged between 11.09 and 14.75 years ( $M = 12.68$ ;  $SD = 0.42$ ). The majority of participants was born in the Netherlands (95.2%). Different educational levels were represented in the sample: pre-vocational (8.0%), pre-college (22.9%) and pre-university (28.7%). There were also participants with a mixed educational level (17.5% pre-vocational/pre-college; 22.9% pre-college/pre-university).

The participants belonged to six different cohorts of students followed during their first three grades of secondary education ( $n_{\text{cohort}_{2010-2012}} = 283$ ;  $n_{\text{cohort}_{2010-2011}} = 315$ ;  $n_{\text{cohort}_{2011-2013}} = 288$ ;  $n_{\text{cohort}_{2012-2014}} = 303$ ;  $n_{\text{cohort}_{2013-2014}} = 266$ ;  $n_{\text{cohort}_{2014}} = 286$ ; see Table A in the Appendix). We investigated whether the correlations between fear of negative evaluation, social avoidance, likeability and popularity were similar for the different cohorts. We used Fisher's  $r$ -to- $z$  transformations and selected  $p < .001$  as cut-off as we made many comparisons. None of the correlations between the variables within and across grades differed for the cohorts. Therefore, we decided to treat the six cohorts as one final sample of 1741 adolescents followed from grade 7 to 9 (irrespective of the year in which the data was collected)<sup>11</sup>.

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<sup>10</sup> In the Netherlands there are three educational levels in secondary schools: a lower (pre-vocational; called VMBO), a middle (pre-college; called HAVO), and a higher (pre-university; called VWO) educational level. Depending upon which educational level adolescents are in, high school either lasts 4 years (VMBO), 5 years (HAVO), or 6 years (VWO). In the current data collection, adolescents from all three different educational levels participated in Grade 7, 8, and 9. However, adolescents from the lower educational track (VMBO), did not participate in the study in Grade 10, because they had to focus on their final exams and we did not want to distract them by any means. The sample in Grade 10 was therefore more selective as it only consisted of students from the middle and higher educational levels. Due to this, we decided to focus on the data of Grade 7, 8 and 9, and to exclude all data from Grade 10.

<sup>11</sup> We also tested whether there were significant cohort differences in our longitudinal model by using multiple group comparisons in Mplus. Only cohorts 1, 3 and 4 could be compared, as these cohorts participated in all three grades. A fully constrained and unconstrained model were tested. Results showed that there were no significant or substantial differences in model fit of these two models. We therefore concluded that the longitudinal model was similar for these three cohorts (the model fit and comparison statistics are presented in Table B in the Appendix).

## Measures

### ***Popularity (peer report)***

Computerized peer nomination methodology was used to measure adolescents' popularity. Participants were asked whom they considered 'most popular' and 'least popular' in their classroom. The nomination question was presented at the top, followed by the names of all classmates. Participants could nominate as many or as few classmates as they wanted, with a minimum of one. They could nominate same-sex and other-sex classmates, but self-nominations were not permitted (van den Berg & Cillessen, 2013). The number of nominations received for each question was counted per participant and standardized within classrooms to control for differences in classroom size. Next, the difference between most popular and least popular nominations was computed, again standardizing this composite score within classroom (Cillessen & Marks, 2011). A higher score indicated higher levels of popularity.

### ***Likeability (peer report)***

Following the same procedure, participants nominated classmates whom they 'liked most' and 'liked least' in their classroom. For both items, nominations received were summed per participant and standardized within classroom. Next, a difference score between most liked and least liked nominations was computed, again standardizing this composite score within classrooms (Cillessen & Marks, 2011). A higher score indicates higher levels of likeability.

### ***Social avoidance (peer report)***

To measure social avoidance, the same peer nomination procedure was used. The only difference was that participants were also able to nominate none of their classmates for this question. Participants were asked who best fitted the description "*Who of your classmates does not say much or sits often alone?*". Again, the number of received nominations was computed and standardized within classroom. A higher score indicated more social avoidance.

### ***Fear of negative evaluation (self-report)***

The Dutch translation of the Brief Fear of Negative Evaluation Scale (Brief-FNE; Leary, 1983) was administered to measure individuals' levels of fear of negative

evaluation. This questionnaire consists of twelve items, example items are: *"I am worried about what others might think of me, even though I know it does not matter"* and *"I am afraid that others will disapprove me"*. Participants had to indicate how much each item describes themselves, on a 7-point Likert scale ranging from *"not at all"* to *"very much"*. Typically the Brief Fear of Negative Evaluation Scale consists of a 5-point Likert scale. However, to ensure consistency between the scales of all measures in the longitudinal study, the scale was transformed to a 7-point Likert scale. The upper- and lower-end anchors of the scale remained the same. The Brief-FNE was found to be a valid and reliable instrument (Collins et al., 2005; Rodebaugh et al., 2004). In our study the internal consistency of the questionnaire was good at all grades, with Cronbach's  $\alpha$  ranging from .87 to .89 across grades (Field, 2009). After inversely recoding four of the items, a total score was computed by summing all items, with higher scores indicating higher levels of fear of negative evaluation. This total score was standardized across all participants.

All standardized scores of popularity, likeability, social avoidance and fear of negative evaluation below -3 and above 3 were truncated to -3 and 3 respectively (0.85% of scores; Tabachnick & Fidell, 2007).

## Procedure

Each year, the school formally requested the research and agreed to be responsible for the parental consent procedure. The school requested passive parental permission at the beginning of the school year. Adolescents were asked to give assent at the start of each assessment. This study has been approved by the Ethics Committee of the Faculty of Social Sciences, Radboud University in Nijmegen. Data collection took place at school. Adolescents completed the assessment individually on a netbook computer during a 45- to 60-minutes classroom session. All desks were placed in a test setup, with some distance between them. Partitioning screens were placed at each desk to ensure confidential responding. Prior to assessment, the researchers explained the goal and set up of study. They remained present during assessment to answer questions. Different instruments were administered, including self-report questionnaires and sociometric assessment procedures. Written and audio instructions were provided at the beginning of each individual measure. At the end, all participants received a small thank-you present.

## RESULTS

### **Preliminary steps: missing data, assumption testing and variable distribution**

In the final sample of 1741 participants, there were 43 adolescents who repeated a grade in grade 7, 8 or 9. For these adolescents, we removed the data from the duplicate grade onwards. Moreover, 27.3% of the data was missing, either because participants were not present during an entire grade or because they did not finish all measures in time. Data were missing completely at random, since Little's MCAR test showed that the normed  $\chi^2$  ratio was 1.40 (i.e.,  $< 3$ ; Ulman, 2013). All missing data for the aggregated variables popularity, likeability, fear of negative evaluation and social avoidance are automatically handled using the Full Information Maximum Likelihood (FIML) option in Mplus version 8.6. For the sociometric data, for children who did not participate in a given wave, FIML handled missing scores for popularity, likeability, and social avoidance which represent the opinion of peers regarding the missing child. We used the FIML procedure as it is less biased and more efficient compared to other missing data techniques (Peters & Enders, 2002). Previous studies used the same technique to handle missing data for peer nominations (e.g., Park et al., 2022). For data processing and analyses, all data were grouped by grade instead of by yearly wave.

First of all, we conducted some preliminary analyses to test the assumptions for multiple regression analyses, and to explore the distribution of our variables. Assumptions were tested for popularity, likeability, fear of negative evaluation and social avoidance as outcome variables. No significant outliers nor influential cases were found (Cook's distances  $< 1$ ). Observations were independent from each other (Durbin-Watson test ranged between 1.5 and 2.5). There were no issues with multicollinearity (tolerance  $> .01$  and VIF  $< 10$ ). For popularity, likeability and fear of negative evaluation, the assumptions of homoscedasticity and normality of residuals were met, but these assumptions were violated for social avoidance. To handle these violations, the maximum likelihood estimation with robust standard errors (MLR estimator) was used in Mplus. Descriptive statistics of all variables in grade 7, 8, and 9 are shown in Table 1.

## **Correlational analyses: comparing the strength of the associations between popularity, likeability, fear of negative evaluation, and social avoidance**

Second, we used Pearson's correlation analyses to investigate how the variables were related to each other. We found moderate to high stability of likeability, popularity, fear of negative evaluation, and social avoidance across grades. Popularity and likeability were weakly to moderately correlated within and across all grades. Fear of negative evaluation and social avoidance were positively but only weakly correlated to each other within and across grade 8 and 9. They were not significantly correlated within grade 7 or from grade 7 to 8 or 9. Social avoidance correlated negatively and moderately to strong with popularity and likeability, both within and across grades. Fear of negative evaluation was significantly but weakly related to popularity within all grades and across most of the grades. Fear of negative evaluation was in general not related to likeability, with the exception of the positive but weak correlation between likeability in grade 8 and fear of negative evaluation in grade 9. The correlations between all variables at all grades are presented in Table 2.

We also examined the strength of the correlations with Fisher's *r*-to-*z* transformations and Steigers' equations with a two-tailed test (Lee & Preacher, 2013). We used this procedure to examine whether (1) the correlations with the social status components were stronger for social avoidance than for fear of negative evaluation, and (2) the correlations with social avoidance and fear of negative evaluation were stronger for popularity than for likeability. We only made comparisons when at least one correlation was significant. In general, results showed that the correlations between popularity and social avoidance, and between popularity and fear of negative evaluation were significantly stronger than the correlations between likeability and fear of negative evaluation and social avoidance (*z*-scores range between -3.70 and -13.73, *ps* < .05 across grades). There was one exception: the link between FNE and social status was not different for popularity and likeability in grade 7, although the correlations showed a similar trend. At the same time, the correlations between social status components and social avoidance were significantly stronger than the correlations between popularity and fear of negative evaluation, and between likeability and fear of negative evaluation (*z*-scores range between -10.63 and -20.36, *ps* < .001 across grades). Table C in the Appendix presents all details about the comparisons of the correlations.

**Table 1**  
*Means and standard deviations of popularity, likeability, fear of negative evaluation, and social avoidance per grade*

|                          | Grade 7 |       |       | Grade 8 |       |      | Grade 9 |       |       |       |      |       |       |       |       |
|--------------------------|---------|-------|-------|---------|-------|------|---------|-------|-------|-------|------|-------|-------|-------|-------|
|                          | N       | M     | SD    | Min     | Max   | N    | M       | SD    | Min   | Max   | N    | M     | SD    | Min   | Max   |
| <b>Raw nominations</b>   |         |       |       |         |       |      |         |       |       |       |      |       |       |       |       |
| Least popular            | 1375    | 3.37  | 5.42  | 0.00    | 27.00 | 1374 | 3.72    | 5.69  | 0.00  | 26.00 | 1129 | 3.24  | 5.00  | 0.00  | 25.00 |
| Most popular             | 1375    | 3.68  | 5.23  | 0.00    | 25.00 | 1374 | 4.10    | 5.73  | 0.00  | 26.00 | 1129 | 3.98  | 5.16  | 0.00  | 21.00 |
| Least liked              | 1375    | 1.99  | 2.84  | 0.00    | 20.00 | 1374 | 1.91    | 2.77  | 0.00  | 21.00 | 1129 | 1.80  | 2.54  | 0.00  | 17.00 |
| Most liked               | 1375    | 3.59  | 2.16  | 0.00    | 13.00 | 1374 | 3.75    | 2.20  | 0.00  | 12.00 | 1129 | 4.42  | 2.50  | 0.00  | 15.00 |
| Socially avoidant        | 1375    | 1.93  | 4.38  | 0.00    | 28.00 | 1373 | 2.15    | 4.53  | 0.00  | 25.00 | 1129 | 2.03  | 4.02  | 0.00  | 28.00 |
| <b>Main variables</b>    |         |       |       |         |       |      |         |       |       |       |      |       |       |       |       |
| Popularity <sup>z</sup>  | 1375    | -0.00 | 0.98  | -3.31   | 3.08  | 1374 | -0.00   | 0.98  | -3.07 | 2.64  | 1129 | -0.01 | 0.98  | -3.07 | 2.47  |
| Likeability <sup>z</sup> | 1375    | -0.00 | 0.98  | -4.03   | 2.46  | 1374 | 0.01    | 0.98  | -3.92 | 2.31  | 1129 | -0.00 | 0.97  | -4.18 | 2.48  |
| FNE                      | 1193    | 41.15 | 10.95 | 12.00   | 72.00 | 1308 | 41.44   | 11.13 | 12.00 | 72.00 | 1060 | 41.94 | 10.86 | 12.00 | 72.00 |
| Social avoidance         | 1375    | 0.00  | 0.98  | -0.77   | 5.15  | 1373 | -0.01   | 0.96  | -0.88 | 4.94  | 1129 | -0.00 | 0.97  | -0.88 | 5.08  |

Note. <sup>z</sup> = standardized variable. Sample size differs per variable and per grade due to missing data.

**Table 2**

*Pearson's correlations between fear of negative evaluation, social avoidance, likeability, and popularity for grade 7, grade 8, grade 9 (white), and across waves (grey) including autocorrelations (black)*

|                | Grade 7 |         |         |       | Grade 8 |         |         |         | Grade 9 |         |         |         |
|----------------|---------|---------|---------|-------|---------|---------|---------|---------|---------|---------|---------|---------|
|                | 1.      | 2.      | 3.      | 4.    | 1.      | 2.      | 3.      | 4.      | 1.      | 2.      | 3.      | 4.      |
| Grade 7        |         |         |         |       |         |         |         |         |         |         |         |         |
| 1. FNE         | --      | .05     | -.01    | -.07* | .61***  | .05     | -.01    | -.07*   | .56***  | .03     | -.01    | -.07    |
| 2. Avoidance   | --      | -.41*** | -.70*** |       | .05     | .76***  | -.26*** | -.62*** | -.00    | .60***  | -.29*** | -.55*** |
| 3. Likeability |         | --      | .42***  |       | .01     | -.35*** | .57***  | .35***  | .02     | -.31*** | .46***  | .30***  |
| 4. Popularity  |         |         | --      |       | -.03    | -.62*** | .21***  | .84***  | -.05    | -.53*** | .29***  | .72***  |
| Grade 8        |         |         |         |       |         |         |         |         |         |         |         |         |
| 1. FNE         |         |         |         | --    | .11***  | .03     | -.09**  |         | .66***  | .08**   | .04     | -.08**  |
| 2. Avoidance   |         |         |         |       | --      | -.35*** | -.70*** |         | .07*    | .64***  | -.33*** | -.55*** |
| 3. Likeability |         |         |         |       |         | --      | .25***  |         | .07*    | -.23*** | .53***  | .19***  |
| 4. Popularity  |         |         |         |       |         |         | --      |         | -.10**  | -.55*** | .29***  | .78***  |
| Grade 9        |         |         |         |       |         |         |         |         |         |         |         |         |
| 1. FNE         |         |         |         |       |         |         |         | --      | .09**   | .06     | -.10**  |         |
| 2. Avoidance   |         |         |         |       |         |         |         |         | --      | -.39*** | -.70*** |         |
| 3. Likeability |         |         |         |       |         |         |         |         |         | --      | .37***  |         |
| 4. Popularity  |         |         |         |       |         |         |         |         |         |         | --      |         |

Note. FNE = fear of negative evaluation. Sample size differs per variable and for each correlation due to missing data. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

## Longitudinal analyses: examining the predictive associations between popularity, likeability, fear of negative evaluation, and social avoidance

### Model construction

Cross-lagged panel models were conducted in Mplus version 8.6 (Muthén & Muthén, 2017) to examine the longitudinal relations between social status components and fear of negative evaluation and social avoidance, and test for gender differences in these relations. As the assumptions of homoscedasticity and normality of residuals were violated for social avoidance, we used the maximum likelihood estimation with robust standard errors (MLR estimator). Missing data were automatically handled using Full Information Maximum Likelihood (FIML). Several longitudinal models were tested. A non-significant chi-square test,  $p > .05$ , indicated a good model fit, as well as CFI  $> .95$ , RMSEA  $< .06$ , SRMR  $< .08$ , (Hu & Bentler, 1999), and lower Akaike information criterion (AIC) values. If the model fit was not appropriate, modification indices above 10 which made theoretically



sense (Muthén & Muthén, 2017) were considered<sup>12</sup>. Significant change in model fit between the models was tested using the Sattora-Bentler scaled chi-square difference test (Sattorra & Bentler, 2010). The difference between models was evaluated as substantial if  $\Delta CFI \geq .010$ ,  $\Delta RMSEA \geq .015$ , and  $\Delta SRMR \geq .010$  (Chen, 2007). All model fit and comparison statistics are presented in Table 3.

**Table 3**

*Model fit indices and model comparisons of Models 1-3 (N = 1741)*

| <b>Models</b>                                   | <b><math>\chi^2</math></b>    | <b>df</b>                     | <b>p</b> | <b>CFI</b>                     | <b>RMSEA</b>                     | <b>SRMR</b>                     | <b>AIC</b>                     |
|---|-------------------------------|-------------------------------|----------|--------------------------------|----------------------------------|---------------------------------|--------------------------------|
| Model 1: Theoretical model                      | 149.63                        | 24                            | <.001    | 0.978                          | 0.055                            | 0.033                           | 33668.238                      |
| Model 1a: Model 1 + modification <sup>a</sup>   | 102.44                        | 23                            | <.001    | 0.986                          | 0.045                            | 0.028                           | 33616.059                      |
| Model 1b: Model 1a + modification <sup>b</sup>  | 75.51                         | 22                            | <.001    | 0.991                          | 0.037                            | 0.022                           | 33587.644                      |
| Model 1c: Model 1b + modification <sup>c</sup>  | 55.91                         | 21                            | <.001    | 0.992                          | 0.035                            | 0.022                           | 33568.057                      |
| Model 1d: Model 1c + modification <sup>d*</sup> | 30.40                         | 20                            | .064     | 0.998                          | 0.017                            | 0.014                           | 33539.105                      |
| Model 2: Fully unconstrained (1d)'              | 60.54                         | 40                            | .020     | 0.996                          | 0.024                            | 0.020                           | 33169.853                      |
| Model 3: Fully constrained (1d)                 | 115.93                        | 86                            | .017     | 0.995                          | 0.020                            | 0.042                           | 33150.717                      |
| <b>Comparisons</b>                              | <b>SB <math>\chi^2</math></b> | <b><math>\Delta df</math></b> | <b>p</b> | <b><math>\Delta CFI</math></b> | <b><math>\Delta RMSEA</math></b> | <b><math>\Delta SRMR</math></b> | <b><math>\Delta AIC</math></b> |
| Model 1 – Model 1a                              | 41.80                         | 1                             | <.001    | -0.008                         | 0.010                            | 0.005                           | 52.179                         |
| Model 1a – Model 1b                             | 26.40                         | 1                             | <.001    | -0.005                         | 0.008                            | 0.006                           | 28.415                         |
| Model 1b – Model 1c                             | 22.57                         | 1                             | <.001    | -0.001                         | 0.002                            | 0.000                           | 19.587                         |
| Model 1c – Model 1d                             | 12.46                         | 1                             | <.001    | -0.006                         | 0.018                            | 0.008                           | 28.952                         |
| Model 1 – Model 1d                              | 93.14                         | 4                             | <.001    | -0.020                         | 0.038                            | 0.019                           | 129.133                        |
| Model 1d – Model 2                              | 30.14                         | 20                            | .068     | 0.002                          | -0.007                           | -0.006                          | 369.252                        |
| Model 1d – Model 3                              | 85.96                         | 66                            | .050     | -0.003                         | -0.003                           | 0.028                           | 388.388                        |
| Model 2 – Model 3                               | 56.59                         | 46                            | .136     | 0.001                          | 0.004                            | -0.022                          | 19.136                         |

*Note.* CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion. <sup>a</sup>= Autoregressive path from fear of negative evaluation grade 7 to grade 9 is added.

<sup>b</sup>= Autoregressive path from popularity grade 7 to grade 9 is added. <sup>c</sup>= Autoregressive path from likeability grade 7 to grade 9 is added. <sup>d</sup>= Autoregressive path from withdrawal grade 7 to grade 9 is added. \* = Final model.

Model 1 was our theoretical model and examined the bidirectionality between popularity, likeability, fear of negative evaluation and social avoidance over time. Stability paths for all variables were estimated from grade 7 to 8, and from grade 8 to 9. Cross-lagged paths from social status components at grade 7 and 8 to fear of negative evaluation and social avoidance at grade 8 and 9 respectively were included, as well as the opposite cross-lagged paths (from fear of negative

<sup>12</sup> The modification index is the  $\chi^2$  value, with 1 degree of freedom, by which model fit would improve if a particular path was added or constraint freed. In other words, the modification indices indicate which paths in the model should be added or constraint to result in a better model fit.

evaluation and social avoidance to social status components). Within-grade correlations between all variables were controlled for. Model 1 was estimated for the total sample. The model fit statistics were inconsistent: CFI, RSMEA and SRMR indicated good model fit, while chi-square did not. Modification indices suggested to include the autoregressive parameters of the variables from grade 7 to grade 9, indicating high stability of the variables over time. We added these paths using a stepwise procedure (beginning with the path with the highest modification index). Specifically, Model 1a included the autoregressive path for fear of negative evaluation; Model 1b for fear of negative evaluation and likeability; Model 1c for fear of negative evaluation, likeability and popularity; and Model 1d for fear of negative evaluation, likeability, popularity and social avoidance. Models 1a to 1c had a good model fit according to all fit indices, except the chi-square test. The model fit of Model 1d was good according to all indices, including the chi-square test. Adding the extra paths significantly increased the model fit each time. The model fit of Model 1d was significantly and substantially better than the original Model 1. Hence, Model 1d functioned as our final theoretical model.

### ***Gender differences in the longitudinal model***

We used the procedure of multiple group comparisons to examine whether there exist gender differences in our longitudinal model. All these models were based upon Model 1d. Model 2 was a fully unconstrained model, in which all parameters were freely estimated across gender. Model 3 was a fully constrained model, in which all parameters were constrained to be equal across gender. The model fit of both models was appropriate according to most fit indices, but not according to the chi-square index. The model fit of Model 2 and 3 did not significantly or substantially differ from each other, nor did they differ from the model fit of Model 1, our theoretical model. These results indicated that the theoretical model does similarly apply to boys and girls, thus that certain gender differences do not exist. The most parsimonious model, which is the theoretical model, Model 1, was therefore chosen as final model.

### ***Final model***

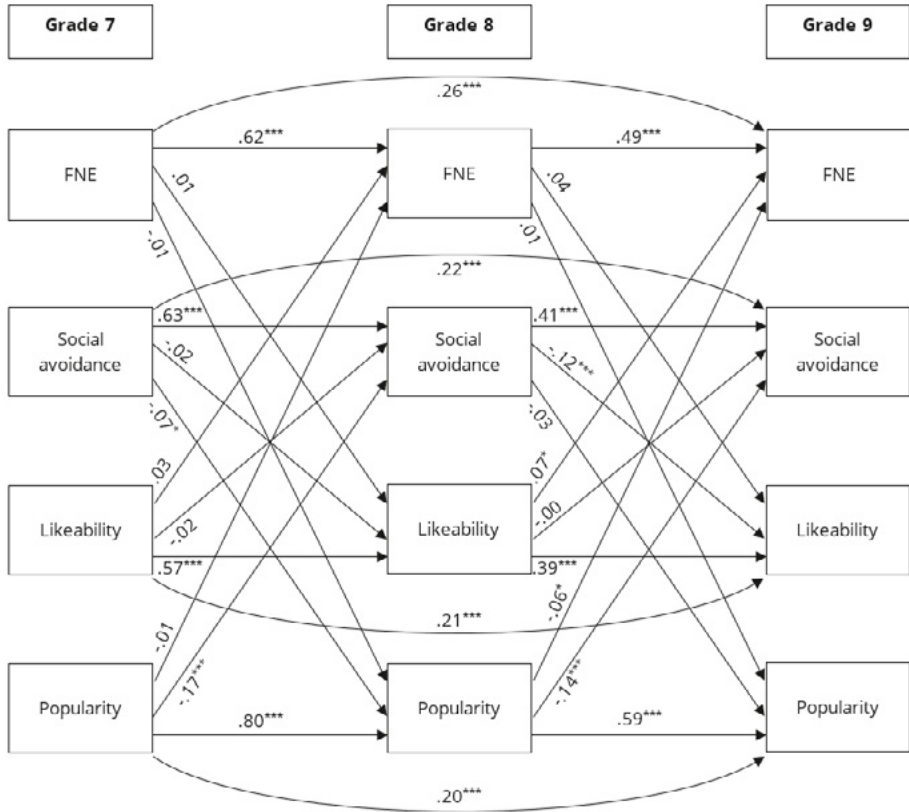
Figure 1 shows an overview of all longitudinal paths of the final model, Model 1. All autoregressive paths were positive and significant. Effect sizes ranged from moderate to strong. Higher levels of likeability, popularity, fear of negative

evaluation and social avoidance at a certain grade predicted higher levels of these variables at a later grade. These results indicate stability of social anxiety related constructs and social status across adolescence. The autoregressions were strongest from grade 7 to grade 8, and lowest from grade 7 to grade 9.

Regarding the cross-lagged effects, popularity in grade 7 and 8 negatively predicted social avoidance one year later. Lower popularity ratings by peers thus increased the risk of showing social avoidance over time. The opposite direction was also found, where more social avoidance at grade 7 predicted lower popularity levels at grade 8. Social avoidance at grade 8 negatively predicted likeability at grade 9. More social avoidance thus resulted in being less liked by peers. The effects from popularity and likeability at grade 8 to fear of negative evaluation at grade 9 were in opposite directions. Specifically, this effect was negative for popularity, meaning that being less popular resulted in more fear of negative evaluation over time. Contrary, for likeability this effect was positive, indicating that being more liked predicted more social anxious cognitions. All significant cross-lagged paths were weak in size. All other cross-lagged paths were non-significant.

**Figure 1**

Representation of longitudinal standardized estimates of the final model (Model 1d)



Note. For clarity of presentation, concurrent correlations between the variables are not presented. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

## DISCUSSION

This study aimed to examine the bidirectional longitudinal link between social status components and social anxiety related constructs during three yearly waves in adolescence. The current study was one of the first longitudinal studies focusing on both directions of the relationship in one model and subdividing social status and social anxiety into specific components (i.e., popularity and likeability) and symptom types (fear of negative evaluation and social avoidance). Gender differences in all associations were explored. Obtaining a better understanding of the development and maintenance of these subcomponents could aid in

preventing the negative consequences and persistent trajectories of low social status and heightened social anxiety. In general, we found evidence for negative reciprocity between social status and social anxiety related constructs during adolescence as assumed by the transactional model. However, this bidirectional relationship was largely dependent upon the specific components of social status (popularity vs. likeability) and social anxiety related constructs (fear of negative evaluation vs. social avoidance) under investigation.

### **The link between popularity, likeability, fear of negative evaluation, and social avoidance**

We found a negative bidirectional relationship between popularity and social avoidance from grade 7 to 8 (e.g., the first two years of secondary education). Showing more social avoidance increased the risk of becoming less popular among peers over time, probably because avoidance eventually limits socialization opportunities and may cause social skills deficits in the long run (Greco & Morris, 2005). At the same time, lower popularity among classmates was related to an increased risk of social avoidance from the peer group. Social avoidance may serve as a safety strategy for less popular adolescents, in order to avoid the risk to be actively excluded from the peer group or to become victimized (Zimmer-Gembeck et al., 2014). From grade 8 to 9 only one direction of the relationship between popularity and social avoidance was found, specifically from popularity in grade 8 to social avoidance in grade 9.

Social avoidance was not only longitudinally related to lower popularity, but also to lower likeability. More social avoidance in grade 8 predicted lower likeability ratings by their peers in grade 9. This finding was consistent with work by Biggs et al. (2010) showing that higher social anxiety symptoms in adolescence predicted being less accepted by peers five months later. These results suggest that social anxiety related constructs might negatively affect individuals' social status in the group due to for instance inappropriate social skills or self-selection of maladaptive friendships (Kochel et al., 2012).

We also found evidence for a longitudinal link between the social status components and fear of negative evaluation. Popularity and likeability in grade 8 predicted fear of negative evaluation in grade 9. Strikingly, the direction of these effects was opposite for popularity and likeability. Individuals had a higher risk of

experiencing more fear of negative evaluation over time when being seen as less popular, but also when being more liked. The result that lower popularity was related to increased fear of negative evaluation was in line with our expectations and could be explained by the fact that problematic peer relationships such as low popularity are stressful (Kochel et al., 2012; Sentse et al., 2017). Contrary, the finding that being less liked also predicted an increase in fear of negative evaluation was surprising, but seemed in hindsight plausible. Higher liked adolescents are maybe more concerned by maintaining their likeability status, predicting increased social fear. In addition, scholars suggests that being afraid to be negatively evaluated by others is part of the profile of highly liked individuals. These individuals show more prosocial behavior and compliance to others, which might make them more liked by peers (Leary, 1983).

Overall, our results were largely in line with the conclusions of the previous study by Henricks et al. (2021). However, a major difference is that in the previous study, only support for the interpersonal risk model was found. Less popular girls increased in social avoidance and distress over time. In the current study more longitudinal relationships were found in line with the transactional model. The discrepancy in findings could be due to a difference in the operationalization and measure of behavioural social anxiety constructs, or because of the use of a larger time interval (Keijsers & van Roekel, 2018).

### **Stronger links between several subcomponents of social status and social anxiety related constructs**

Our cross-sectional results suggested that likeability and popularity were more strongly related to social avoidance than to fear of negative evaluation, which was in line with previous research (Flanagan et al., 2008; Henricks et al., 2021). This finding could be explained by the fact that social avoidance is observable for peers, while fear of negative evaluation is not. Social avoidance may also have more impact on social status, as it may lead to limited socialization with peers and precipitates social skills deficits (Greco & Morris, 2005). Of course, it could be questioned whether our findings are caused by the use of different informants to measure the variables (de los Reyes & Kazdin, 2005). Social status components and social avoidance were assessed via peer nominations, in contrast to self-reported fear of negative evaluation. It seems plausible that due to using the same

informant, the link between social avoidance and social status is stronger than the association between fear of negative evaluation and social status. However, in a previous study where fear of negative evaluation and social avoidance were assessed both via self-reports, we also found a stronger link between social avoidance and the social status components (Henricks et al., 2021), providing evidence that this result is probably not simply caused by methodological reasons.

Similar to our expectations, the associations of social anxiety related constructs with social status were also stronger for popularity than for likeability, which was also found by other studies (Dijk et al., 2018; Henricks et al., 2021). A reason for this could be that adolescents with social anxiety perceive the social context in a more hierarchical way and view relationships as more competitive than their non-anxious counterparts. They may thus experience problems with dominance, hierarchies, and social ranking in specific (Aderka et al., 2009; Gilbert & Trower, 2001), factors which are closely related to popularity. Contrary, difficulties with likeability may be experienced to a lesser extent, as adolescents with social anxiety often appease others and show socially desirable behaviours (Catarino et al., 2014; Gilbert, 2014), which may not result in more negative likeability nominations by peers. Another argument for a stronger link with popularity than likeability could be that being unpopular is more threatening than being disliked due to its association with victimization, loneliness and a lack of friendships (Hopmeyer Gorman et al., 2011).

## **Gender differences**

Our results suggested that the associations between social status components and social anxiety related constructs were similar for boys and girls. This was contrary to previous studies showing stronger links for girls (Henricks et al., 2021; la Greca & Lopez, 1998; Modin et al., 2011) or boys (Flanagan et al., 2008; Storch et al., 2005), but was in line with one earlier study showing no gender differences between social status and social anxiety in adolescents (la Greca & Harrison, 2005). The lack of significant gender differences in our model could have resulted from the fact that we investigated a slightly older age group than earlier studies. Some researchers have namely argued that gender differences in general might be most pronounced during early adolescence (Petersen & Taylor, 1980) due to the fact that girls experience pubertal maturation earlier than boys (Wohlfahrt-Veje et al., 2016).

## **Strengths, limitations, and future directions**

This study adds to the existing literature by adopting a prospective study design and investigating specific components of social status and social anxiety related constructs during adolescence. The major strengths of this study include the use of a large sample and the fact that adolescents are followed across a relatively long time span in early and mid-adolescence. Nevertheless, it should be noted that this study was not without limitations. Yet these provide interesting suggestions for future research.

First of all, we used different informants to measure the variables and this may have affected the findings (de los Reyes & Kazdin, 2005). Likeability, popularity and social avoidance were measured with peer nominations, and fear of negative evaluations with a self-report questionnaire. By using the same informant, the link between social avoidance and social status could be stronger than the association between fear of negative evaluation and social status. In future research, multiple methods and reporters ought to be considered to exclude this alternative explanation.

Second, it seems plausible that the transition from grade 7 to 8 was experienced differently for adolescents than the change from grade 8 to 9. In the specific secondary school participating in this study, the peer context remained relatively the same from grade 7 to 8 as adolescents stayed with their peers in the same class. However, after grade 8 adolescents were distributed differently over the classes based upon their chosen education level. Consequently, there is more change within classes from grade 8 to grade 9, possibly influencing the peer nomination variables as the new peer context calls for a new social hierarchy. Future research would benefit from including a secondary school in which the transitions between grades are similar (e.g., within each grade the classes are mixed) to better compare the longitudinal link between social status and social anxiety related constructs as confounding factors such as a new peer context are then excluded.

Second, to obtain a more detailed understanding about the interplay between social status and social anxiety related constructs, it would be interesting to examine the constructs directly after entering secondary school as social anxiety symptoms elevate after educational transitions (Grills-Taquechel et al., 2010)



and this completely new peer context requires social status formation. Instead of our yearly intervals across three grades, having a measurement burst design (Sliwinski, 2008) with multiple measurement moments with short time-intervals at the beginning of grade 7 would probably lead to a better investigation of the relationship between social status and social anxiety related constructs as the concepts are examined during a critical period.

For future research it would also be interesting to explore mechanisms underlying the longitudinal association between social status and social anxiety related constructs to understand the developmental links between the two social constructs in greater detail. Several theoretical frameworks have suggested the role of different underlying factors. For instance, the symptoms-driven model suggests that adolescents with social anxiety may have social skills deficits which evoke certain reactions by the peer group, resulting in a lower social status (Kochel et al., 2012; Sentse et al., 2017). According to the interpersonal risk model social anxiety arises because adolescents with a low social status do not experience that they belong to a group, or experience support from their peers, which interferes with their basic human needs (Kochel et al., 2012; Sentse et al., 2017). The sociometer theory (Leary & Baumeister, 2000) and the social rank theory (Price & Sloman, 1987) have postulated the role of low self-esteem and own perceived low social status within a peer group. These internal worries and feelings of being unworthy to peers may induce social anxiety feelings and behaviour, and may evoke a certain reaction by the peer group (Gilbert, 2000). Future research could concentrate on examining these potential underlying factors such as poor social skills, interference with basic human needs of belongingness and support, negative self-perceptions and low self-esteem and thereby unravelling the complex longitudinal link between social status and social related constructs.

## **Clinical implications**

Although this study focused on a community sample<sup>13</sup>, social avoidance and FNE were meaningfully associated with social status, suggesting potential clinical implications. Our findings showed that there was a negative perpetuating cycle

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<sup>13</sup> In our community sample, the mean scores on Fear of Negative Evaluation ranged between 41.15 and 41.95 across grades. A previous study looking at a clinical sample of individuals with social phobia showed a mean score of FNE of 51.5 (Collins et al., 2005).

between lower popularity and more social avoidance. Avoiding social situations is a rather short-term solution, and may in fact maintain or worsen social fears (Hofmann & Hay, 2018; Wong & Rapee, 2016). This was also supported by our study, as results showed that social avoidance resulted in being less liked by peers, and that low popularity may also lead to increasing fear of negative evaluation. To prevent more severe negative consequences of low social status and heightened social anxiety in the future, such as victimization and exclusion from the peer group (de Bruyn et al., 2010; Siegel et al., 2009), it seems necessary to interrupt the negative cycle between social avoidance and popularity. Although not measured in our study, social avoidance in social anxiety is often fear-driven. It seems thus important to reduce the underlying fears to subsequently prevent social avoidance. One way of doing this is by teaching adaptive coping strategies including cognitive reappraisal and acceptance (Schäfer et al., 2017) to improve how adolescents handle social stressful situations. Another way of preventing social avoidance, especially for low popular adolescents, is via the use of exposure therapy. Previous research actually found that exposure in vivo is as effective as cognitive therapy and might be the most cost effective intervention for social anxiety disorder (Powers et al., 2008). Our findings also highlight the central role that exposure should play in current treatment, as especially social avoidance was related to social status, while fear of negative evaluation was less important.

## Conclusion

The present study contributed to the current body of adolescent research by adopting a bidirectional prospective longitudinal design to investigate the associations between different aspects of social status and social anxiety related constructs across three yearly waves in adolescence. Although the effect sizes of the bidirectional relationships were relatively small, results showed that in general there was reciprocity between social status and social anxiety related constructs, in line with the transactional model. The associations were however different for the specific social components. A negative bidirectional relationship was found between social avoidance and popularity: lower popularity predicted more social avoidance and vice versa. Showing more social avoidance increased the risk of being seen as less liked over time. Both social status components predicted fear of negative evaluation, but in opposite directions: being less popular or being more liked predicted elevated levels of fear of negative evaluation. No

gender differences were found. In conclusion, the findings show the necessity of distinguishing between different social status components and cognitive and behavioural correlates of social anxiety in order to obtain a comprehensive understanding of these constructs.

## **ACKNOWLEDGEMENTS**

We are grateful to the parents, teachers, and school administrators who made this research possible. Also thanks to all the research assistants who helped with the data collection. Special thanks to Giovanni ten Brink for his help with programming and processing of the data.

## APPENDICES

**Table A**

*Distribution of final sample across cohorts (N = 1741)*

| Cohort | N    | Year    |         |         |         |         |
|--------|------|---------|---------|---------|---------|---------|
|        |      | 2010    | 2011    | 2012    | 2013    | 2014    |
| 1      | 283  | Grade 7 | Grade 8 | Grade 9 | -       | -       |
| 2      | 315  | Grade 8 | Grade 9 | -       | -       | -       |
| 3      | 288  | -       | Grade 7 | Grade 8 | Grade 9 | -       |
| 4      | 303  | -       | -       | Grade 7 | Grade 8 | Grade 9 |
| 5      | 266  | -       | -       | -       | Grade 7 | Grade 8 |
| 6      | 286  | -       | -       | -       | -       | Grade 7 |
| Total  | 1741 |         |         |         |         |         |

*Note.* The total sample consisted of participants who were at least present during one grade, and for participants who duplicated a grade, the data from the duplicate grade onwards was removed.

**Table B**

*Model fit indices and model comparisons of the fully constrained and unconstrained model for cohorts 1, 3, and 4 (N = 874)*

| Models                       | $\chi^2$    | df          | p    | CFI          | RMSEA          | SRMR          | AIC          |
|------------------------------|-------------|-------------|------|--------------|----------------|---------------|--------------|
| Model 1: Fully unconstrained | 59.83       | 60          | .482 | 1.000        | 0.000          | 0.019         | 21185.144    |
| Model 2: Fully constrained   | 146.02      | 152         | .622 | 1.000        | 0.000          | 0.038         | 21108.769    |
| Comparisons                  | SB $\chi^2$ | $\Delta df$ | p    | $\Delta CFI$ | $\Delta RMSEA$ | $\Delta SRMR$ | $\Delta AIC$ |
| Model 1 – Model 2            | 86.54       | 92          | .641 | 0.000        | 0.000          | -0.019        | 76.375       |

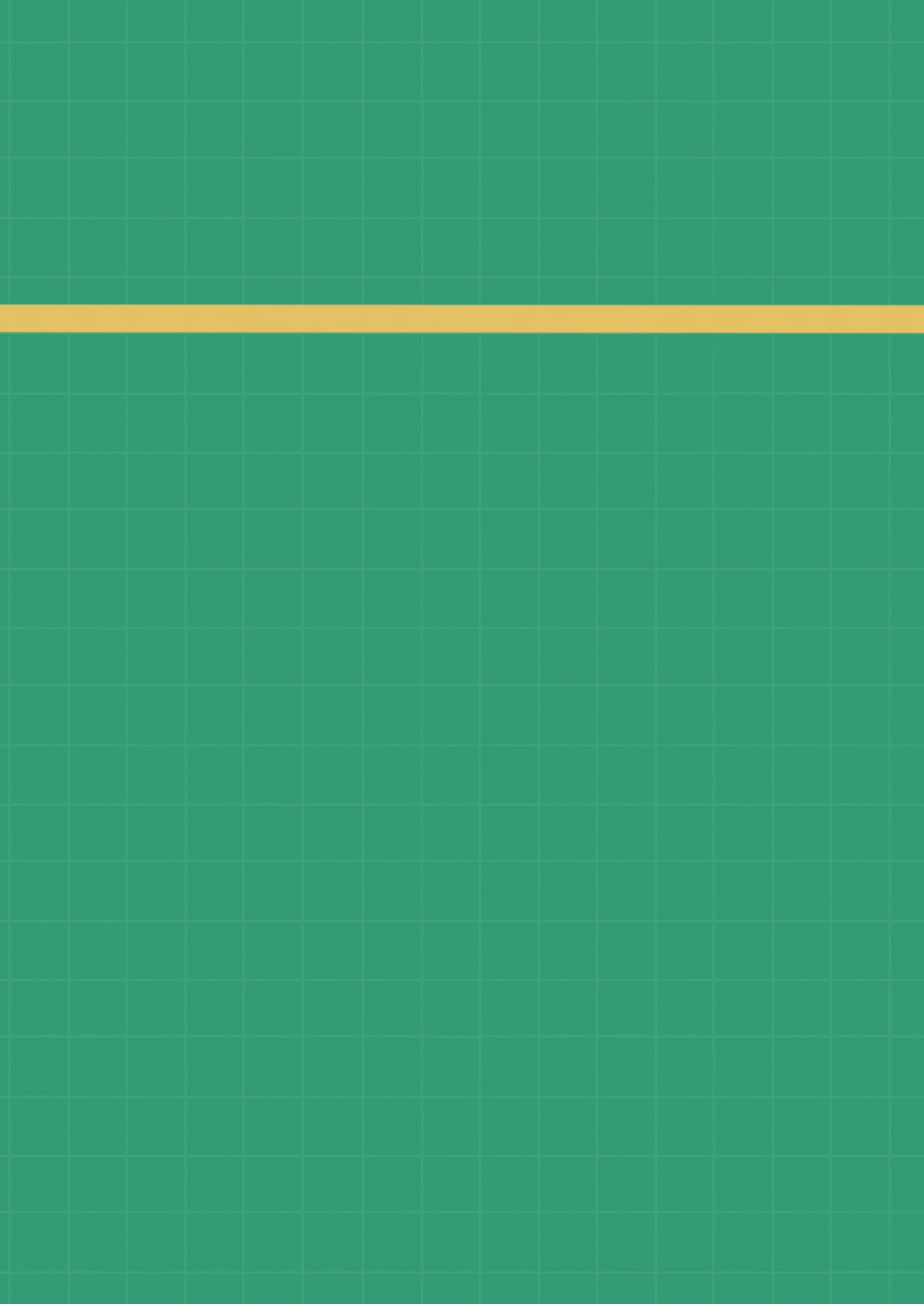
*Note.* CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion.

**Table C**

*Comparison of the strength of the correlations using Fisher's r-to-z transformations and Steigers' equations with a two-tailed test (Lee & Preacher, 2013)*

| Correlation 1           | Correlation 2           | Grade 7   | Grade 8   | Grade 9   | Conclusion                          |
|-------------------------|-------------------------|-----------|-----------|-----------|-------------------------------------|
|                         |                         | z         | z         | z         |                                     |
| popularity – FNE        | likeability – FNE       | -1.71     | -3.70***  | -4.55***  | popularity – FNE is stronger        |
| popularity – avoidance  | likeability – avoidance | -13.13*** | -13.73*** | -12.23*** | popularity – avoidance is stronger  |
| avoidance – popularity  | FNE – popularity        | -19.68*** | -20.36*** | -18.12*** | avoidance – popularity is stronger  |
| avoidance – likeability | FNE – likeability       | -10.63*** | -10.92*** | -11.45*** | avoidance – likeability is stronger |

*Note.* FNE = fear of negative evaluation. N is not equal for each correlation, because there are missing data for FNE but not for the peer-nomination variables. If the N's were different, we used the smaller N in the test. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .



# Chapter 6

## General discussion

## **SOCIAL ANXIETY IN ADOLESCENCE**

Social anxiety is quite common among youth (Kessler et al., 2012; Wicks-Nelson & Israel, 2009) and is characterized by fear of negative evaluation (i.e., cognitive symptoms) and behavioural symptoms, e.g., the avoidance of social situations (American Psychiatric Association, 2013). For some individuals, social fears exacerbate to clinical levels referred to as social anxiety disorder (SAD), with a mean age of onset at 15 years (Mancini et al., 2005). SAD can have severe consequences, including comorbid problems such as depression, other anxiety disorders, and substance use (American Psychiatric Association, 2013; Beesdo et al., 2007), and an increased risk for suicidal ideation and attempts (Cougle et al., 2009). Strikingly, even non-clinical social anxiety can have negative consequences (Weeks et al., 2009), such as peer victimization (Erath et al., 2007), impairments at school (e.g., lower grades, failing a year or school drop-out), and difficulties with relationships with friends, family, colleagues, or romantic partners (Aderka et al., 2012; Mazzone et al., 2007; Porter & Chambless, 2014; Stein & Kean, 2000; Vilaplana-Pérez et al., 2021).

When left untreated, SAD often follows a chronic pattern, with lifelong experience of symptoms (Keller, 2006). It would thus be optimal to prevent feelings of social anxiety from exacerbating to a clinical level. Unfortunately, the availability of selective prevention programs is limited (except for Aune & Stiles, 2009), possibly, because the theoretical foundations of social anxiety are not well understood (Kashdan & Herbert, 2001). The overarching aim of this dissertation was therefore to gain more insight into how two important risk factors: maladaptive cognitive biases (i.e., attention bias and interpretation bias; Chapters 2 and 3) and low social status (i.e., popularity and likeability; Chapters 4 and 5) contribute to the onset and maintenance of social anxiety in adolescence, the most critical period for the exacerbation of social anxiety (Beesdo et al., 2011).

This final chapter provides an overview of the main findings of each chapter and integrates the results of the different studies into existing knowledge on risk and maintaining factors of social anxiety in adolescence. In addition, general strengths and limitations of the research and directions for future research are discussed. The chapter ends with concluding remarks and the implications of this dissertation for the scientific field and (clinical) practice.

## THE ROLE OF COGNITIVE BIASES IN SOCIAL ANXIETY

According to several theories, negative attention bias (i.e., the tendency to direct the attention toward potentially threatening stimuli) and interpretation bias (i.e., the tendency to interpret ambiguous social situations negatively) are causally related to social anxiety (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). However, longitudinal evidence for this proposition is limited. Furthermore, attention bias can be divided into the enhanced engagement to threat as well as the difficulty with disengagement from threat (Blicher et al., 2020). Most studies in adolescents only examined one aspect of attention bias (e.g., Shechner et al., 2013), or used tasks which are unable to discriminate the different components (e.g., the dot-probe task; Clarke et al., 2013; Koster et al., 2004). The lack of studies examining the subcomponents of attention bias may have led to inconsistent evidence on attention bias in youth (Morren et al., 2004; Telzer et al., 2008; Waters et al., 2011). Finally, most studies ignored the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006), stating that different biases are interrelated and interact with each other rather than contributing independently to psychopathology.

To address these issues, I examined the longitudinal predictive effects of attention biases (both looking at enhanced engagement to threat and at difficulty with disengaging from threat), and interpretation bias on social anxiety in Chapter 2. In addition, the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006) was tested by looking at the direct link between attention bias and interpretation bias, and by examining the interaction between both biases in predicting social anxiety. In total, 816 adolescents participated in the study described in Chapter 2. Participants were followed over three years in adolescence, from grade 7 to grade 9 (11-16 years old;  $M_{\text{age grade 7}} = 12.60$  years). Social anxiety was measured via self-report, interpretation bias via verbal vignettes, and attention biases via a visual search task with pictures of emotional faces. In this visual search task, adolescents were presented with a 4x3 grid of faces. These faces were unfamiliar to the participants but represented youth of similar age. All faces either had a happy, angry or neutral expression, except for one (e.g., one face was looking happy, while the rest showed a neutral expression). Participants had to detect the face that was the odd one out as fast as possible, by clicking on the face which had a different expression



than the others. The latency in milliseconds that it took to click on the face, was recorded. Two attention bias scores were calculated: (1) speeded engagement of attention, by calculating the difference score of the mean latency of the angry-in-neutral trials minus the happy-in-neutral trials; (2) delayed disengagement of attention, by calculating the difference score of the mean latency of the neutral-in-happy trials minus the neutral-in-angry trials.

### **The longitudinal role of attention bias and interpretation bias**

Concerning attention biases, it was found that delayed disengagement of attention was weakly to moderately stable over time, but speeded engagement of attention fluctuated across the waves. None of the attention bias indices predicted social anxiety in any of the grades. Interpretation bias, on the other hand, showed high stability over time. In addition, more negative interpretation bias in grade 7 predicted an increase in social anxiety symptoms in grade 8. Interpretation bias in grade 8 however, did not predict social anxiety in grade 9. Finally, no support was found for the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006): attention bias and interpretation bias were not longitudinally related, nor did they interact with each other in predicting social anxiety. Taken together, the results of Chapter 2 suggest that interpretation bias rather than attention bias is associated with the increase in social anxiety over time. The CCBH was not confirmed, rather our results suggest that different cognitive biases operate independently.

The lack of findings regarding attention bias is contrary to cognitive theories stressing the importance of attention bias in the onset and maintenance of social anxiety (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). However, these results add to the current field of research showing mixed and inconclusive evidence concerning the role of attention bias in youth' social anxiety (Morren et al., 2004; Puliafico & Kendall, 2006; Roy et al., 2008; Telzer et al., 2008; Waters et al., 2011). Possibly, it could be concluded that attention bias does not play an important role in adolescents' social anxiety.

Contrary, the absence of results concerning the role of attention bias in social anxiety could also be explained by several methodological issues and operationalization difficulties. For instance, the visual search task used to measure attention biases is a reaction time paradigm, often resulting in unreliable data in youth (Brown et

al., 2014; Wermes et al., 2017). The type of facial stimuli may also be a reason for the lack of findings. In the study of Chapter 2, pictures of angry faces were used, as angry expressions of peers may prompt the fear of rejection in socially anxious individuals (Rinck & Becker, 2005). However, some studies suggested that using stimuli with other negative facial expressions may be more suitable for socially anxious adolescents. For instance, the disgusted faces of peers may trigger the desire to avoid these peers in socially anxious individuals, leading to social withdrawal and avoidance behaviour (Buckner et al., 2010). The reason why we selected angry faces, is because anger is better recognized by youth than disgust (Bijsterbosch et al., 2021).

Another methodological reason for the lack of findings regarding attention biases is that, in our study, two attention bias components were distinguished: enhanced engagement to threat and delayed disengagement from threat, which is in line with recent attention bias theories (Richards et al., 2014). However, it could also be that the vigilance-avoidance pattern of processing may be the most important aspect of attention bias in socially anxious individuals. This pattern is constituted of fast detection of threat and a subsequent quick visual avoidance of threat. Avoidance may prevent the exposure and subsequently the objective evaluation and extinction of social threatening stimuli (Amir & Bomyea, 2010; Mogg et al., 1997). The visual search task was not able to track the time course of attention bias processing and could therefore not measure this vigilance-avoidance pattern. Another study also showed the importance of tracking the time course of attention bias processing, as a negative attention bias was only found in the first 500 milliseconds after stimulus presentation (Gamble & Rapee, 2009).

In addition, contrary to the interpretation bias task in which participants were asked to imagine themselves in the situation described, the attention bias task did not induce self-relevance within the task, as it just asked to detect a face. Although attention biases are supposed to be triggered by social cues in general, Vassilopoulos & Banerjee (2012) found that a negative bias is mostly triggered in self-relevant situations. This may explain why attention bias was not related to social anxiety. Finally, other research has also shown a conceptual difference between the cognitive biases: while attention bias is a more fluctuating, state-like type of cognitive bias (Bar-Haim et al., 2010; Li et al., 2008; Zvielli et al., 2015), interpretation bias is better described as a more stable trait-like characteristic

(Creswell & O'Connor, 2011). The design of the study, with yearly intervals, may thus be more suitable to grasp interpretation bias processes than attention bias in adolescents.

The results of interpretation bias confirmed the existing cognitive theories (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). However, the result that interpretation bias on social anxiety was only present from grade 7 to grade 8 but not from grade 8 to grade 9, is contrary to a meta-analysis showing that the link between interpretation bias and social anxiety increases with age (Stuijzand et al., 2018). The reason why interpretation bias could only predict social anxiety in the earlier grades is possible because adolescents entered a new peer group in grade 9. These social contextual changes may have complicated our findings as it is unsure how the new peer context impacts the relationship between interpretation bias and social anxiety (e.g., it could either elevate social fears or could bring positive opportunities to adolescents who were bullied in their previous context).

### **The Combined Cognitive Bias Hypothesis**

The fact that no support was found for the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006) was unexpected as two previous studies did find a direct link between attention and interpretation bias in social anxiety of children and adolescents (Rozenman et al., 2014; Watts & Weems, 2006), and a recent meta-analysis also provided support for the CCBH in anxiety (Leung et al., 2022). It could be that there is simply no support for the CCBH in adolescence. Attention bias and interpretation bias may rather function as two separate processes. This could be explained by neurocognitive models stating that the brain processes more automatic (i.e., attention biases) and more effortful controlled biases (i.e., interpretation bias) in a different way (Cunningham et al., 2004). In line with this reasoning, it is important to study attention bias and interpretation bias as separate processes to understand their contribution to social anxiety development. However, it would also be possible that the CCBH only applies to a specific subsample of adolescents, due to the high heterogeneity among socially anxious individuals (Binelli et al., 2015). For instance, it may be that the CCBH only applies to adolescents with low self-esteem and social competence, as these concepts are found to be related to both cognitive biases and social anxiety (Miers

et al., 2013; Tran et al., 2011; van Tuijl et al., 2014). Unfortunately, the findings of this dissertation are inconclusive about these individual differences. Future studies should explore the possible moderating role of such constructs in relation to the CCBH.

Another explanation for the lack of support for the CCBH is related to the methodological difficulties when measuring attention bias in particular (as extensively discussed earlier). In addition, attention bias and interpretation may not be related to each other, because of the nature of the response modulus to both tasks. Attention bias is measured in a somewhat implicit way via a reaction time paradigm, while interpretation bias is measured explicitly (e.g., participants consciously respond to the interpretations). At the same time, both tasks used different modalities (i.e., verbal vignettes for the interpretation bias task but pictures of emotional faces for the attention bias task). The use of implicit versus explicit, and visual versus verbal stimuli, may have complicated the possibility to estimate the link between these different cognitive biases, particularly because the degree of social fears was also assessed with a verbal (verbal) explicit measure.

### **The development of a new pictorial task for interpretation bias**

To overcome the modality differences when assessing attention biases and interpretation bias (i.e., a limitation of Chapter 2), we developed a new pictorial task to assess interpretation bias in Chapter 3 (the Schloss Einstein-Radboud Social Ambiguous Images [SERSAI] task). In this task, 35 pictures of socially ambiguous scenarios were presented. Each scenario was accompanied by a positive and negative interpretation of the scenario. To trigger self-relevance, we used pictures in which the actors looked at another person who was not at all or only partly visible (e.g., only an arm or shoulder) in the picture. This way, participants could be instructed to imagine themselves in that person's position. Using pictorial stimuli to assess interpretation bias may also have other benefits since it could increase the ecological validity and social salience compared to verbal tasks. Specifically, pictures of social ambiguous scenarios provide a more naturalistic representation and give more information to participants via for instance facial expressions, gestures, body postures, or situational cues than an abstract verbal description (Haller et al., 2016). In addition, pictorial tasks rely less heavily on literacy skills and are therefore useful for younger children or youth with learning difficulties.

The SERSAI task is also more related to traditional attention bias tasks, which often use pictorial stimuli as well. It, therefore, reduces method variance and has the potential to contribute to a better investigation of the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006). The picture stimuli of the SERSAI task are, however, still distinct from common attention bias tasks, which often use pictures of emotional faces. A recent meta-analysis showed that using facial stimuli to measure interpretation bias, limits the effect size (Chen et al., 2020). Facial stimuli namely have some disadvantages in measuring interpretation bias: they do not provide a social context, so the stimuli are too simplistic and may not be ecologically valid, or do not allow much interpretative space as most facial expressions are accurately recognized (Bijsterbosch et al., 2021; Blanchette & Richards, 2010; Chen et al., 2020; Gaskell & Marslen-Wilson, 2001). At the same time, another study also found that the effect of emotional facial stimuli was dependent upon the number of stimuli used: socially anxious individuals became more sensitive to disapproval when more angry faces were presented (Douilliez et al., 2012). Therefore, for the SERSAI task, we chose pictures of social scenarios instead, as these better represent the complexity of peer interactions in real life.

In the study described in Chapter 3, it was tested how the pictorial interpretation bias task, the SERSAI task, was related to more traditional verbal vignette tasks for interpretation bias and social fears in 329 adolescents (12-18 years old;  $M_{\text{age}} = 14.95$  years). For social fears we used two different self-reports, making a distinction between fear of negative evaluation (i.e., the core cognitive and emotional component of social anxiety), and social anxiety symptoms in general (i.e., also including behavioural and physical symptoms). The two interpretation bias tasks were moderately correlated to each other, providing evidence that they measure the same underlying concept and that the newly developed pictorial was thus able to assess interpretation bias in adolescents. This is the first proof of convergent validity of the SERSAI task. The SERSAI task was able to detect a more pronounced negative interpretation bias for adolescents with higher fear of specifically negative evaluation but not for adolescents with a higher level of social anxiety as assessed with a more general measure. This result implied that the SERSAI task was able to measure the more cognitive and emotional components of social anxiety but not to detect more general symptoms of social anxiety, including physical and behavioural social anxiety symptoms as well. Contrary, using the traditional verbal task, we did find a negative interpretation bias for adolescents with a heightened fear of negative evaluation and with higher social anxiety symptoms in general.

An explanation for why the SERSAI task was not related to social anxiety in general, could have something to do with the level of mental imagery and self-relevance with the task. There is an ongoing debate whether pictorial stimuli facilitate or complicate mental imagery and self-relevance, and therefore trigger emotional processes such as interpretation bias, more or less. On the one hand, researchers have argued that pictures can enhance imagination (Pictet & Holmes, 2013). Visual stimuli are processed faster, because they are immediately connected to affective systems in the brain, in contrast to verbal information which first has to be processed by a language-related brain system (i.e., the lexicon; de Houwer & Hermans, 1994). The route towards emotional processing is thus shorter for pictures and may therefore be stronger compared to verbal stimuli. On the other hand, pictures may provide too many details, leaving not much room for own imagination. This latter idea was supported by two studies showing that participants had more difficulties engaging with unfamiliar visual stimuli than with verbal stimuli (Lisk et al., 2018) and that they found it harder to vividly imagine pictorial scenes (de Voogd et al., 2017). Future research should further investigate which of these explanations is most plausible. While the SERSAI task was more closely related to attention bias assessment with regard to modality (i.e., both using pictures), the SERSAI task was less associated with the mode of assessing social anxiety with text-based questionnaires. This could explain why the SERSAI task was not related to general social anxiety symptoms, in contrast to text-based vignettes to assess interpretation bias.

Even though the pictorial task, the SERSAI task, was able to assess interpretation bias in adolescents, the traditional verbal task is currently still the preferred method to investigate interpretation bias related to social fears in adolescents, as this task was also related to general symptoms of social anxiety. However, we do believe that with further improvement of the pictorial task, it could be a useful addition to the research field, especially if one is specifically interested in levels of fear of negative evaluation. Suggestions for improvement are to shorten the SERSAI task, as it is rather lengthy (105 responses were required from the participants), and to audio-record the interpretations to increase its user-friendliness, especially for youth with reading difficulties. In addition, it would be necessary to formally test its psychometric properties (e.g., test-retest reliability, content validity, and construct validity) and to investigate whether the SERSAI task actually improved the ecological validity and social salience compared to more traditional verbal tasks, as was expected.

## THE ROLE OF SOCIAL STATUS IN SOCIAL ANXIETY

Apart from cognitive factors, social status in the peer context has also been identified as a crucial aspect in the development of social anxiety in adolescence. Social status is typically divided into popularity and likeability (van den Berg et al., 2020). There are theoretical reasons to assume that these social status subcomponents may relate differentially to cognitive (i.e., fear of negative evaluation) and behavioural (i.e., social avoidance and withdrawal) social anxiety symptoms (Aderka et al., 2009; Alden & Taylor, 2004; Catarino et al., 2014; Cillessen & Marks, 2011; Gilbert, 2014; Gilbert & Trower, 2001; Greco & Morris, 2005; Lansu & Cillessen, 2012; Sandstrom & Cillessen, 2006; Weisman et al., 2011). Although research did make efforts to test the individual effects of popularity and likeability, most studies focused on social anxiety as one general construct. At the same time, to date, there is no study investigating all subcomponents of social status (i.e., popularity, likeability) and social anxiety (i.e., cognitive and behavioural symptoms) simultaneously. This may have resulted in an unclear or distorted picture of the link between social status and social anxiety.

Actually, the link between social status and social anxiety can be explained by three different theoretical models (Kochel et al., 2012; Sentse et al., 2017). First of all, the interpersonal risk model suggests that low social status increases the risk of social anxiety. Secondly, the symptoms-driven model assumes that socially anxious adolescents cause, at least to some extent, problematic peer relationships themselves. Finally, the transactional model integrates both the interpersonal risk model and the symptoms-driven model, by suggesting that social status and social anxiety are bidirectionally related to each other (Kochel et al., 2012; Parker et al., 2005; Sentse et al., 2017). Up until now, longitudinal evidence is limited but this is necessary to be able to formally test which of the three theoretical models is most accurate.

Therefore, in Chapters 4 and 5, cross-sectional as well as longitudinal links between social status (i.e., popularity and likeability) and social anxiety (i.e., cognitive and behavioural symptoms), were examined simultaneously. In addition, both chapters explored possible gender differences in the link between social status and social anxiety components. Popularity and likeability were assessed via peer nominations and cognitive symptoms of social anxiety via self-report questionnaires in both studies. In Chapter 4, 274 adolescents from grade 7 and grade 8 participated and they filled in the measures at two different time points

with six months in between (11-15 years old;  $M_{\text{age wave 1}} = 12.55$  years). Behavioural symptoms were self-reported in the study in Chapter 4. In Chapter 5, a total of 1741 adolescents participated who were followed from grade 7 to grade 9, at three time points with one year in between (11-17 years old;  $M_{\text{age grade 7}} = 12.68$  years). Behavioural symptoms were assessed via peer nominations in Chapter 5.

## **Popularity, likeability, cognitive symptoms, and behavioural social anxiety symptoms**

Both studies confirmed that, in general, the cross-sectional relationships between both social anxiety symptoms and popularity were stronger than the associations between cognitive and behavioural social anxiety symptoms and likeability. This is in line with the theory of Gilbert & Trower (2001) stating that socially anxious individuals overutilize the social rank system and subsequently view social relationships more hierarchically, seeing others as competitors. Individuals with social anxiety consider themselves inferior to others and therefore actively try to avoid harm, rejection, or being passed over by peers, by behaving in a submissive and appeasing way (Aderka et al., 2009; Gilbert & Trower, 2001; Weisman et al., 2011). Subsequently, they acquire a low position in the social hierarchy, and thus may have a low popularity status. This might lead to more avoidance as a lack of popularity confirms the primary fear of social anxiety, namely the fear to be negatively evaluated by others. In contrast, their likeability status is probably less affected (Sandstrom & Cillessen, 2006), because their submissive and appeasing behaviour (Catarino et al., 2014; Gilbert, 2014) does not impact their capability to initiate and maintain friendships (Rodebaugh et al., 2015; Rose et al., 2011). The finding that popularity is more related to social anxiety than likeability, could also be explained by the idea that unpopularity is more socially threatening than being disliked. Specifically, unpopularity reflects group consensus: often the entire peer group agrees on the unpopularity of a peer (Cillessen & Marks, 2011). Contrary, likeability is a more dyadic process (Lansu & Cillessen, 2012; Marks et al., 2012). If adolescents are in general disliked, they could still have some close friends who may serve as a protective factor against social anxiety (la Greca & Harrison, 2005).

Another interesting finding of the cross-sectional results of both Chapters 4 and 5 is that social status components were more strongly related to behavioural social anxiety symptoms than to cognitive symptoms. This is probably because



behaviour is observable to peers, while cognitions are not. Behavioural social anxiety symptoms such as the avoidance of peer interactions and the withdrawal from social situations limit the socialization opportunities with peers, which may subsequently lead to a decline in social skills (Greco & Morris, 2005) or difficulties with peer interactions (Clark & Wells, 1995). The avoidance behaviour can also be interpreted by peers as if socially anxious adolescents are not interested in having company, making friends, or social interaction in general. This may lead to the peers simply leaving the socially anxious adolescent alone. Regardless of the underlying mechanism at work, by showing avoidance and withdrawal behaviour, socially anxious adolescents could be perceived as less attractive interaction partners, resulting in an increased risk for negative peer evaluations and a low social status (Alden & Taylor, 2004; Bruch & Cheek, 1995; Dodge & Feldman, 1990).

### **Longitudinal link between social status components and social anxiety symptoms**

The longitudinal results of Chapters 4 and 5 shed additional light on the relationships between social status and social anxiety. Chapter 4 only found an effect from popularity at wave one to behavioural social anxiety symptoms six months later, indicating that lower levels of popularity predicted an increase in socially anxious behaviour. None of the other longitudinal links were found in Chapter 4 (e.g., there was no link between likeability and cognitive/behavioural social anxiety symptoms, nor between popularity and cognitive social anxiety symptoms). Chapter 5 replicated the findings from Chapter 4 because again low popularity status predicted higher socially anxious behaviour at a later time point. In addition, Chapter 5 supported the other direction of this relationship, in which more withdrawal behaviour predicted lower popularity levels at a later time point. Chapter 5 also showed that more socially anxious behaviour predicted being less liked by peers. Finally, the study of Chapter 5 found that both a lower popularity status and being more liked by peers resulted in more cognitive symptoms of social anxiety. This final result was quite unexpected but could indicate that highly liked adolescents are maybe more concerned by maintaining their likeability status, predicting increased social fear. Also, it has been argued that being afraid to be negatively evaluated by others is part of the profile of highly liked individuals (Leary, 1983).

The difference in findings between Chapters 4 and 5 could be explained by four reasons. First of all, an explanation for this discrepancy lies in the timeframe of

the longitudinal design of both studies (Keijsers & van Roekel, 2018). In general, examining predictive relationships could be more difficult when larger time intervals are used. However, social anxiety and social status components are found to be less stable when a one-year interval is used compared to a shorter interval of six months (Lu Jiang & Cillessen, 2005; Ronchi et al., 2020; Tillfors et al., 2012). This may explain why more longitudinal effects were found in Chapter 5 compared to Chapter 4. By using a longer time interval of one year and by following adolescents over three years in Chapter 5, we were probably better able to find developmental changes in social status and social anxiety compared to Chapter 4 in which only two measurement moments were included with a six months interval in the same school year.

Second, the larger sample size of Chapter 5 (i.e.,  $N = 1741$ ) compared to Chapter 4 (i.e.,  $N = 274$ ) allowed for more powerful conclusions.

A third reason for the different findings in Chapters 4 and 5 is the difference in measuring behavioural social anxiety symptoms. By using peer nominations in Chapter 5, instead of self-reports in Chapter 4, the study of Chapter 5 used a more objective measure of social withdrawal as socially anxious adolescents are found to have a biased way of reporting the frequency and severity of their social withdrawal behaviours (Cartwright-Hatton et al., 2005; Miers et al., 2009). In Chapter 4, participants may have overestimated their social anxiety behaviours, while in fact, their peers did not notice these behaviours. This may explain why social anxiety behaviours did not have an impact on their social status.

Fourth and finally, behavioural social anxiety symptoms were differently operationalized in both chapters. In Chapter 4, participants were asked to indicate their social avoidance behaviour as well as their experienced distress during social situations. However, in Chapter 5, we only assessed participants' withdrawal behaviour, making a more concrete distinction between different symptom types of social anxiety, contrary to Chapter 4 in which behavioural and cognitive symptoms have, to some extent, been blended in the same measure. This difference may explain why in Chapter 4 only one effect from popularity to behavioural symptoms was found, contrary to Chapter 5 in which a bidirectional effect between popularity and behavioural avoidance was found, as well as the effect from social withdrawal to likeability. The blended measure of distress and avoidance in Chapter 4 might have weakened the effects of behavioural social anxiety symptoms on social status components.

One of the other major differences between the results of Chapters 4 and 5 is the gender differences in the link between social status and social anxiety. While Chapter 5 found no gender differences at all, Chapter 4 concluded that a longitudinal link from popularity to behavioural social anxiety symptoms was only present for girls but not boys. There is inconclusive evidence from both chapters regarding gender differences in the association between peer relations and social anxiety. Prior research on this topic was also inconclusive: some studies showed that the association was stronger for boys (Flanagan et al., 2008; Storch et al., 2005), or girls (la Greca & Lopez, 1998; Modin et al., 2011) but others found no gender differences between social status and social anxiety in adolescents (la Greca & Harrison, 2005). This difference in results between both chapters could be due to the fact that the sample of Chapter 5 was older (ages ranged from 11 to 17 years) than in Chapter 4 (ages ranged from 11 to 15 years). Researchers have argued that gender differences are most pronounced during early adolescence (Petersen & Taylor, 1980), as girls experience pubertal maturation earlier than boys (Wohlfahrt-Veje et al., 2016). The gender difference may become less apparent in later adolescence when boys also experience pubertal changes.

### **The transactional model**

Up until now, the link between social status and social anxiety could be explained by three different theoretical frameworks (Kochel et al., 2012; Sentse et al., 2017). First of all, the interpersonal risk model assumes that low social status increases the risk of social anxiety because social anxiety mostly arises if the social environment is negative or when social relationships are conflicting and unsupportive. The idea behind the interpersonal risk model is that individuals have a basic need for support and belongingness (Kochel et al., 2012; Sentse et al., 2017). When these needs are violated (which might be the case when individuals have a low social status), psychological symptoms such as social anxiety increase.

Second, the symptoms-driven model suggests that socially anxious adolescents are responsible for, at least to some extent, a low social status themselves (Kochel et al., 2012; Sentse et al., 2017). For instance, due to their poor social skills, the self-selection of maladaptive friendships, or because they behave in such a way that makes them an easy target for victimization (Kochel et al., 2012). Regarding the first explanation, there is an ongoing debate whether individuals with social

anxiety indeed have a social skills deficit or whether their social performance is disrupted because of their anxiety (Lange et al., 2014; Schneider & Turk, 2014). Regardless of the underlying reason, research consistently found that individuals with social anxiety disorder are more negatively evaluated by others, because of their direct and more subtle behavioural deviations (Heerey & Kring, 2007; Lange et al., 2014; Voncken et al., 2008).

Third, and finally, the transactional model combines both the explanations of the interpersonal risk model and the symptoms-driven model, by arguing that there is an ongoing interaction between social status and social anxiety (Kochel et al., 2012; Sentse et al., 2017). In other words, according to the transactional model, social anxiety and social status continuously influence each other, in some sort of vicious cycle. Peers may negatively interpret socially anxious behaviour, resulting in negative peer interactions and low social status. This, in turn, confirms the core fear of socially anxious individuals: the fear to be negatively evaluated by others. As a result, both cognitive and behavioural social anxiety symptoms further increase (Kochel et al., 2012; Morris, 2001; Ollendick & Hirshfeld-Becker, 2002; Parker et al., 2005; Spence & Rapee, 2016).

Taking all findings together, Chapter 4 only provided evidence for the interpersonal risk model (as low popularity predicted socially anxious behaviour but not vice versa) but Chapter 5 showed support for the transactional model. Specifically, both directions of the relationship between social status components and social anxiety symptoms were found. Thus, the transactional model probably best describes the relationship between social status and social anxiety. Both factors may influence each other in a bidirectional way, together constituting a vicious cycle.

## **TOWARDS AN INTEGRATED MODEL OF COGNITIVE BIASES, SOCIAL STATUS, AND SOCIAL ANXIETY**

The studies of the current dissertation focused on the separate contribution of the role of cognitive biases (Chapters 2 and 3) and social status (Chapters 4 and 5) on social anxiety. This was an important first step in this area of research as it helped in understanding the onset and maintenance of social anxiety in adolescents. The studies explored possible working mechanisms which should be targeted in prevention and treatment programs for social anxiety. In line with Bronfenbrenner's ecological theory, there is probably an ongoing interaction between both cognitive biases and social

status (Bronfenbrenner & Morris, 2006). Future research should therefore focus on integrating both risk factors in one model and examine their dynamic interplay in the onset and maintenance of social anxiety. This will allow for a more integrative and comprehensive understanding of individual (i.e., cognitive biases) and contextual (i.e., social status) risk factors of social anxiety in adolescence. Based on the current status of the literature and the findings of the studies described in this dissertation, I propose a theoretical model that could explain how cognitive biases, social status, and social anxiety may be related during adolescence (see Figure 1).

This self-developed theoretical model is comparable to the model of Higa-McMillan & Ebesutani (2011), which also highlights the role of cognitive biases and negative peer relationships (e.g., low social status) in social anxiety development. Similar to their model, I assume that social anxiety is a complex phenomenon in which different risk factors may also function as maintaining factors once social anxiety symptoms have been established. Although the model of Higa-McMillan & Ebesutani (2011) defines social anxiety as a combination of behavioural, cognitive, and physiological symptoms, their model does not state whether the different risk and maintaining factors are differently related to these symptom types. In our model, we hypothesize that the strengths of the associations between cognitive biases and social anxiety, and between social status and social anxiety may differ for cognitive and behavioural symptoms. In addition, in our theoretical framework, we further divide cognitive biases into attention bias and interpretation bias, and social status into likeability and popularity, as we assume that the effect sizes of the associations between these different subcomponents and social anxiety symptoms might differ as well.

**Figure 1**

*Theoretical framework regarding the role of cognitive biases and social status in social anxiety in adolescents*



*Note.* The thickness of the arrows indicates the strength of the relationships: the thicker, the stronger this relationship is expected to be.

As seen in this figure, I do not expect cognitive biases and social status to be directly related to each other. Instead, they are rather indirectly linked via social anxiety symptoms. Attention bias and interpretation bias are individual risk factors that are internally processed (Mathews & MacLeod, 2002). Negative information processing styles might not be visible to peers, and therefore do not constitute a direct link with social status. Negative cognitive biases, however, may increase social anxiety symptoms in adolescents (See et al., 2009; Wilson et al., 2006). Peers may notice if individuals are socially anxious, for instance via their behavioural social anxiety symptoms such as (subtle) avoidance and withdrawal behaviours. As a result of these behavioural disruptions, socially anxious adolescents are negatively evaluated by their peers, possibly resulting in a lower social status (Heerey & Kring, 2007; Lange et al., 2014; Voncken et al., 2008). The indirect pathway may also be constituted in the opposite direction, from social status to cognitive biases, via social anxiety. Specifically, adolescents with a low social status might be afraid to be excluded or victimized by their peers, resulting in increased social fear (Kochel et al., 2012; Sentse et al., 2017). Due to their heightened social anxiety levels, it is plausible that they negatively see and interpret the world around them, resulting in negative attention and interpretation bias.

Results of this dissertation showed that attention bias was not associated with interpretation bias and social anxiety. However, instead of concluding that attention bias does not play an important role in adolescents, I rather suggest that attention processes are difficult to grasp in adolescents. Specifically, methodological difficulties with the assessment of attention bias might be the underlying reason why no associations were found between attention bias and interpretation bias, and between attention bias and social anxiety in this dissertation. Future research should attempt to enhance existing tasks or develop new and improved methods.

In contrast to the results of this dissertation, I expect a bidirectional link between attention bias and interpretation bias, in line with the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006), stating that different biases are interrelated with each other. Previous studies supported this notion of the CCBH, as research with children and adolescents found a positive association between attention bias and interpretation bias in different types of anxiety disorders (Rozenman et al., 2014; Watts & Weems, 2006). Individuals who draw their attention more to negative stimuli in their environment would also interpret social cues more

negatively. Vice versa, if they are likely to interpret ambiguous situational cues negatively, they will also focus more on negative stimuli in their environment. This latter process can be described as a sort of type of confirmation bias: they look for environmental cues that confirm their negative interpretation. A recent meta-analysis also supported the CCBH in anxiety as attention bias and interpretation were correlated and could modify each other by training, though these effects were small (Leung et al., 2022).

In this dissertation, cognitive biases were only examined as a risk factor for social anxiety but in accordance with cognitive models, I expect a self-perpetuating cycle between cognitive biases and social anxiety, with both factors negatively influencing each other (Mathews & MacLeod, 2002; Wong & Rapee, 2016). Although links were found between interpretation bias and social anxiety in general, the studies on cognitive biases of this dissertation did not distinguish cognitive from behavioural social anxiety symptoms. It can be expected that attention bias and interpretation bias are especially related to cognitive symptoms of social anxiety, and less so to behavioural symptoms, because both aspects are internal cognitive mechanisms that are processed by similar neural pathways in individuals (Kajimura et al., 2015; Rossignol et al., 2013).

The results of the studies in this dissertation shed additional light on the link between social anxiety and social status. Social anxiety and social status components are bidirectionally related to each other, in line with the transactional model (Kochel et al., 2012; Morris, 2001; Ollendick & Hirshfeld-Becker, 2002; Parker et al., 2005). Lower social status increases the risk to experience social anxiety, and individuals with social anxiety are more likely to obtain a low status in the peer group. However, the strength of this link is largely dependent upon the subcomponents and symptom types under investigation. The link is least apparent for cognitive social anxiety symptoms and likeability status and most apparent for behavioural symptoms and popularity. These assumptions are in line with the evolutionary model of Gilbert & Trower (2001) arguing that socially anxious individuals mostly experience problems with popularity, and the idea that unpopularity is more socially threatening than being disliked (Cillessen & Marks, 2011; Lansu & Cillessen, 2012; Marks et al., 2012). The stronger link with behavioural symptoms versus cognitive symptoms is explained by the fact that behaviour is observable to others, while cognitions are not.

All relationships in the theoretical model of cognitive biases, social status, and social anxiety are expected to be bidirectional. None of the factors can be appointed to as a cause or effect exclusively. The factors rather operate in a cyclic process, continuously influencing each other in both directions. This is consistent with the longitudinal findings of the current dissertation regarding the existence of a transactional model between social status and social anxiety and with cognitive models suggesting a bidirectional relationship between cognitive biases and social anxiety (Mathews & MacLeod, 2002; Wong & Rapee, 2016). To be able to draw conclusions about which factors are precursors of the others, we might need to start the longitudinal investigations at an earlier age, ideally, before social anxiety symptoms are present (Beesdo et al., 2011). However, it could also be that no specific cause-and-effect relationships between cognitive biases, social status, and social anxiety can be found, even if longitudinal studies focus on a young age group. More specifically, this idea is best described by the processes of multifinality and equifinality (Gazelle & Rubin, 2010). According to the principle of multifinality, one risk factor might cause different outcomes for different individuals (e.g., for some individuals negative cognitive biases might result in social anxiety but for others not). Likewise, according to equifinality, different risk factors might cause the same outcome for different individuals. For instance, anxious parents, negative life experiences, bullying, neglecting parents, overprotecting parents, and general behavioural inhibition might all cause social anxiety (Higa-McMillan & Ebesutani, 2011; Wong & Rapee, 2016). To conclude, these principles argue that because of the many different causes and consequences, no specific cause-effect relationship between social anxiety, cognitive biases, and social status can be found.

### **Future research on the link between cognitive biases and social status**

Next to this theoretical model on cognitive biases, social status, and social anxiety, I also have two additional suggestions for future research aiming to combine both factors. First of all, it would be interesting to examine whether negative attention and interpretation biases are mostly activated during interactions with high-status peers. According to the theory of Beck (1976), cognitive biases can be understood from a diathesis-stress framework: negative biases are mostly activated during stressful situations (Abela & D'Alessandro, 2002). Relatedly, negative biases could be strengthened by using self-relevant stimuli in bias tasks (Vassilopoulos & Banerjee,



2012). Although we increased the self-relevance of cognitive biases tasks in the study described in Chapters 2 and 3, we still used hypothetical social scenarios or pictures of unknown peers. A valuable contribution to the current research field would be to examine how cognitive biases are triggered when adolescents are faced with interactions with familiar peers, such as their classmates. Previous studies looking at approach-avoidance tendencies (i.e., an implicit evaluation bias), showed that adolescents were more likely to avoid popular peers, especially when the adolescents themselves were unpopular (Lansu et al., 2012). Following the line of reasoning of the social rank-safety model of Gilbert & Trower (2001), we would expect that for low status or socially anxious adolescents, especially interactions with familiar popular peers are experienced as socially threatening. Therefore, probably negative attention and interpretation biases are also especially triggered in social situations with those popular peers, predicting an increase in subsequent social anxiety feelings. Future studies using implicit cognitive biases tasks with pictures of familiar peers (thereby enhancing self-relevance of the stimuli) would facilitate to be conclusive on this idea.

Second, there is also evidence of a certain bias within the concept of social status. Specifically, adolescents with social anxiety are found to have a biased perception of their social status (Baartmans et al., 2019; Miers et al., 2011). When comparing peer nominations with self-ratings of social status, it was found that socially anxious adolescents believe that they are less liked by others, which is not the case in reality (Christensen et al., 2003; Voncken et al., 2020). Another study showed that they are even more liked than their non-anxious peers (Baartmans et al., 2019). Though these studies showed a cross-sectional link between social anxiety and a negative bias in self-perception of social status, longitudinal evidence is missing. It would be worthwhile to explore the direction between this type of bias and social anxiety symptoms and to determine which of the two comes first. Knowing this would possibly guide current prevention and treatment programs on whether or not to focus on this type of bias in socially anxious adolescents.

## **STRENGTHS, LIMITATIONS, AND FUTURE DIRECTIONS**

The studies of this dissertation have several strengths. First of all, by adopting a longitudinal perspective, this dissertation examined the role of cognitive biases and social status in social anxiety development in adolescence. In addition, by disentangling various facets of these general constructs, a more detailed

understanding of social status, cognitive biases, and social anxiety was provided. More specifically, social status was divided into popularity and likeability; attention bias and interpretation bias were investigated as types of cognitive biases; both the enhanced engagement to threat and the slow disengagement from threat were measured as attention bias constructs; and finally, social anxiety was divided into cognitive and behavioural symptoms.

The different studies also used various measures to try and improve the current methodology (e.g., behavioural social anxiety symptoms were measured with self-report questionnaires in Chapter 4 but with peer nominations in Chapter 5; interpretation bias in Chapter 3 was assessed using verbal vignettes, and our newly developed pictorial task, the SERSAI task). By showing similar results with different measures, the studies provided stronger evidence for the importance of cognitive biases and social status in social anxiety as these results were not simply caused by methodological reasons. Furthermore, another strength of this dissertation was that all studies consisted of large samples (N ranged across studies between 174 and 819 adolescents), allowing for well-powered statistical analyses and conclusions. Finally, consistent with the current movement toward open science, the studies in Chapters 2 and 3 were pre-registered, improving the credibility, replicability, and reproducibility of the research results.

Limitations and directions for future research that related specifically to the empirical studies were already discussed in each respective chapter. However, this dissertation also has some general limitations that provide important directions for future research. Specifically, these limitations revolve around three topics: (1) the developmental course of social anxiety, cognitive biases, and social status, (2) the difference between clinical and non-clinical social anxiety, and (3) methodological issues regarding the assessment methods of cognitive biases and social status. The limitations and suggestions for future research regarding these three topics are discussed in separate subsections below.

### **The developmental course of social anxiety, cognitive biases, and social status**

A first general limitation is that, although the participants who were studied in this dissertation were all in adolescence, the age range across different studies was relatively large (i.e., between 12-18 years). There may have been developmental

differences between the younger and older adolescents with regard to the link between cognitive biases, social status, and social anxiety. Because of this noise in the data, it may have been more complicated to draw conclusions about social anxiety development within and across studies. Results of our studies described in Chapters 2 and 5 show an inconsistent pattern regarding the longitudinal development of social anxiety. On the one hand, Chapter 2 shows an increase in social anxiety symptoms from grade 7 to grade 9, and from grade 8 to grade 9 (mean social anxiety levels did not differ between grades 7 and 8). Chapter 5, on the contrary, showed stability of social anxiety between grades 7, 8, and 9.

Actually, the developmental trajectory of social anxiety symptoms remains fairly unknown due to large inconsistencies between theoretical expectations and empirical findings. From a theoretical point of view, social anxiety symptoms are assumed to peak during middle adolescence (Warren & Sroufe, 2004; Westenberg et al., 2001). This was supported by one study showing a slight increase in symptoms from middle adolescence onward (van Oort et al., 2009). Another study, however, showed that the degree of social anxiety remained fairly stable throughout adolescence (Hale et al., 2008). Yet, another study showed clear gender differences in the development of social anxiety: while the level of social anxiety reduced across adolescence for boys, there was a steep increase in symptoms from early to middle adolescence, followed by a subsequent decrease in symptoms from middle to late adolescence for girls (Nelemans et al., 2014). In other words, support for the theoretical developmental trajectory of social anxiety (Warren & Sroufe, 2004; Westenberg et al., 2001) was found for girls but not for boys.

Similarly, the contributing role of cognitive biases on social anxiety development may be age dependent. Two meta-analyses included studies with experimental, cross-sectional, or longitudinal research designs investigating youth with a broad age range, from early childhood to late adolescence (i.e., 4-17 years old). These meta-analytic studies concluded that there is an increase in the relationships between both attention and interpretation bias and social anxiety from childhood to adolescence (Dudeny et al., 2015; Stuijzand et al., 2018). With increasing age, cognitive biases may crystalize further and become more predictive of interindividual differences in social anxiety symptoms. Our results did not support the findings of these meta-analyses, as Chapter 2 showed the stability of the relation between interpretation bias and social anxiety across grades 7 to 9 ( $r$  ranged between  $-.45$  to  $-.50$ ), without

any age differences. In addition, contrary to the meta-analyses, no link was found between attention bias and social anxiety in any of the grades in Chapter 2.

Finally, research on the developmental course of the importance of social status with regard to social anxiety is scarce. Our results described in Chapter 5 showed a rather stable link between social status components and social anxiety over time ( $r = -.70$  for popularity and social anxiety at all grades;  $r$  ranged between  $-.35$  and  $-.41$  for likeability and social anxiety across grades). In general, it is suggested that social status becomes increasingly important during secondary school (LaFontana & Cillessen, 2010; Pellegrini & Long, 2002). A recent meta-analysis showed that the link between subcomponents of social status (i.e., popularity and likeability) was largely dependent upon age (van den Berg et al., 2020). Specifically, popularity and likeability were more weakly related in older adolescents compared to younger adolescents. Results of our study described in Chapter 5 did not support this latter notion as the correlations between the two subcomponents of social status varied across grades and showed no decreasing trend with increasing age ( $r = .42$  in grade 7;  $r = .25$  in grade 8; and  $r = .37$  in grade 9).

To summarize, future research should further investigate the developmental course of social anxiety, cognitive biases, and social status across childhood and adolescence taking the earlier mentioned limitations of the tasks into account. It may be especially important to focus on a slightly younger age group than the participants included in the studies of this dissertation. For instance, by following youth from middle/late childhood instead of from early adolescence onwards, we could gain more insight into the causal risk factors playing a role in the onset of social anxiety disorder (Beesdo et al., 2011). This will allow us to draw stronger conclusions about possible age differences in the predictive role of cognitive biases and social status on social anxiety. In the end, this may lead to more effective prevention techniques, because it will provide us with a better insight into when exactly negative cognitive biases or low social status should be targeted to prevent an exacerbation of social anxiety symptoms.

### **Social anxiety versus social anxiety disorder**

All participants in our studies were part of a community sample to investigate different levels of social anxiety in adolescents and to be able to investigate factors that may precede the development of social anxiety disorder (SAD). In other

words, we did not pre-screen or select adolescents with heightened or clinical levels of social anxiety. In our studies, the percentage of adolescents diagnosed with SAD was largely consistent with prevalence rates of SAD in earlier studies (e.g., 10-14% in our study described in Chapter 2, compared to 5-16% in previous studies; Burstein et al., 2011; Kessler et al., 2012; Mesa et al., 2011). Although there is empirical evidence showing that social anxiety can be understood as a severity continuum ranging from fearlessness to shyness to SAD (Ruscio, 2010), it would be important to investigate the generalizability of our findings to clinical samples. For instance, our studies contributed to the understanding of possible risk factors initiating social anxiety but both cognitive biases, as well as social status, may also function as maintaining factors once SAD has been diagnosed (Blöte et al., 2015; Higa-McMillan & Ebesutani, 2011). Future research should investigate these possibilities to be able to inform treatment and intervention programs on whether or not cognitive biases and social status should be targeted.

### **Methodological improvements regarding the assessment of cognitive biases and social status**

A third limitation regards the psychometric properties of the cognitive bias tasks used in the studies of this dissertation. It speaks for itself that the pictorial interpretation bias task, the SERSAI task, which we described in Chapter 3, needs further investigation and development to be able to decide whether this task is indeed a reliable and valid method to assess interpretation bias in adolescents (see page 143-144 for an extensive discussion on the specific improvements of the SERSAI task). In addition, the attention bias task in Chapter 2 requires more psychometric research. Attention bias tasks must assess different components of attention bias, including the fast detection of threat and the subsequent quick visual avoidance of threat (i.e., the vigilance-avoidance pattern; Amir & Bomyea, 2010; Mogg et al., 1997). Similarly, cognitive bias tasks should enhance self-reference with the task as biases are particularly triggered in self-relevant situations (Vassilopoulos & Banerjee, 2012). Finally, although the internal consistency and reliability of the verbal vignette tasks to assess interpretation bias in Chapters 2 and 3 are excellent, the validity of these vignettes is unknown. Future research should investigate and report the psychometric properties of different cognitive bias tasks.

As mentioned earlier, social anxiety is a heterogeneous problem: socially anxious individuals see and interpret the most diverse social situations and cues as threatening (Binelli et al., 2015; Spokas & Cardaciotto, 2014). While interpretation bias tasks typically allow for such diversity by describing a variety of social scenarios, the attention bias task is usually only focused on facial expressions. Attention bias, however, could in principle also be focused on a gesture of peers (e.g., turning away, not inviting for a drink, an eye roll, a frown). It would thus be good for future research if attention bias measures also take this diversity into account.

As discussed extensively in Chapters 2 and 3, it is important to use similar tasks of the same modality, to assess attention bias and interpretation bias. Only then it would be possible to rule out any issue with method invariance and to draw stronger conclusions about a possible link between different cognitive biases, in line with the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006). A first step has been made by developing a pictorial task, the SERSAI task, to assess interpretation bias, which is more closely related to traditional measures of attention bias which also often use visual stimuli. From the stimuli set described in Chapter 3, we also selected pictures of positive and negative social situations (in addition to the ambiguous pictures used in the SERSAI task). These positive and negative stimuli could be used in the future to develop a task to assess attention bias (e.g., a free viewing eye-tracking paradigm in which the time is tracked spent looking at the positive and negative scenes). By developing such an additional task for attention bias, we would be able to measure both attention bias and interpretation bias with similar stimuli, facilitating research on the link between different biases. The field would also benefit from attempts to closely link the nature of response modus to attention and interpretation bias tasks. At the moment, attention bias is often measured implicitly (e.g., via reaction times), while interpretation bias is measured explicitly (e.g., participants select their preferred interpretation of a situation). Using a similar way of responding, would remove an important methodological explanation for the lack of findings regarding the relationships between attention bias and interpretation bias.

Another limitation is the way in which social status is assessed. In Chapters 4 and 5 we computed a difference score between the most and least liked peer nomination questions, as an indication of likeability, and between the most and least popular

nominations as an indication of popularity. Using such difference scores is a common practice in the field of research on peer relationships (Cillessen & Marks, 2011). However, more recent research showed that using such difference scores might not be ideal. For instance, it was concluded that popularity and unpopularity are not linearly related and could thus not be viewed as two opposite ends of a single continuum (Marks et al., 2021). Although popularity and unpopularity are negatively correlated to each other, these correlations were only low (Hopmeyer Gorman et al., 2011) to moderate (Lease et al., 2002; van den Berg & Cillessen, 2013). The link with behavioural variables is not in opposing directions, as both popular and unpopular adolescents were characterized by aggression and bullying (Hopmeyer Gorman et al., 2011; LaFontana & Cillessen, 2002; Lease et al., 2002; Xie et al., 2006).

Similarly, adolescents with a low likeability status, in general, may differ in *why* they obtained this low status. It could either be that they were often nominated as least liked, and not often as most liked (i.e., the rejected group), or they were not often nominated as most or least liked at all (i.e., the neglected group). These two groups have distinct behavioural profiles. Rejected adolescents are found to have more problematic outcomes than neglected youth, including aggression, victimization, low prosocial behaviour, depression, loneliness, poor social skills, and social anxiety (Coie et al., 1982; Rytioja et al., 2019). In contrast, the neglected adolescents are often characterized as being less socially active but also show less aggression than the rejected group and are less at risk for developing psychosocial problems (Coie et al., 1982; Newcomb et al., 1993; Rytioja et al., 2019).

Due to these findings, it is thus recommended that popular versus unpopular, and liked versus disliked are not combined into composite scores but are rather examined as separate constructs, though simultaneously included in the same model (Marks et al., 2021). By doing so in future research, we will obtain a better understanding of the role that specific social status components play in social anxiety development.

## **CONCLUDING REMARKS AND IMPLICATIONS FOR RESEARCH AND (CLINICAL) PRACTICE**

This dissertation aimed to better understand the development of social anxiety in adolescence, by gaining more insight into the role of cognitive biases and social status as possible individual and contextual risk factors in a longitudinal

perspective. Taken together all results of the studies of this dissertation, we could conclude that social status (both likeability and popularity) and interpretation bias are contributing factors to social anxiety in adolescence. Our studies do not support the importance of attention bias for youth social anxiety, but this should be further investigated. Especially, the need for more reliable measures to assess attention bias is warranted.

Our studies on cognitive biases extend existing cognitive models of social anxiety in youth (e.g., Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016) and support the idea that it would be especially beneficial to target negative interpretation bias in prevention and treatment for social anxiety. Cognitive therapies might for instance be helpful to improve the negative interpretation style of socially anxious adolescents (Leigh & Clark, 2016). It may also be an interesting idea to explore the usefulness of Cognitive Bias Modification focused on interpretation bias (CBM-I) as an adjunct to existing treatments. Previous studies, however, showed that the effects of CBM-I in youth are rather inconsistent. Some found that CBM-I successfully reduced social anxiety symptoms in anxious youth (Klein et al., 2015; Vassilopoulos et al., 2009; Vassilopoulos & Brouzos, 2016). Others, however, only found evidence for an effect on interpretation bias but not on anxiety levels (Fu et al., 2013; Vassilopoulos et al., 2013). In yet another study, CBM-I failed to produce long-term effects (de Hullu et al., 2017).

We found no support for the Combined Cognitive Bias Hypothesis (Hirsch et al., 2006) as attention bias and interpretation bias were not directly related, nor did they interact with each other. In order to obtain a valid test of the Combined Cognitive Bias Hypothesis, measures should be developed that assess different cognitive biases similarly. We provided the first step in this by developing a new pictorial task, the SERSAI task, to assess interpretation bias in adolescents in a way that is more closely related to traditional measures of attention bias (i.e., by using the same modality). This will allow for a more sufficient test regarding the contributing role and interplay between attention bias and interpretation bias in social anxiety. Future research should continue to focus on developing more comparable measures, for example, by also aligning the type of response for attention bias and interpretation bias tasks.

With regards to the studies on the role of social status, our results suggest that specific components of social status play a unique role, as popularity was more

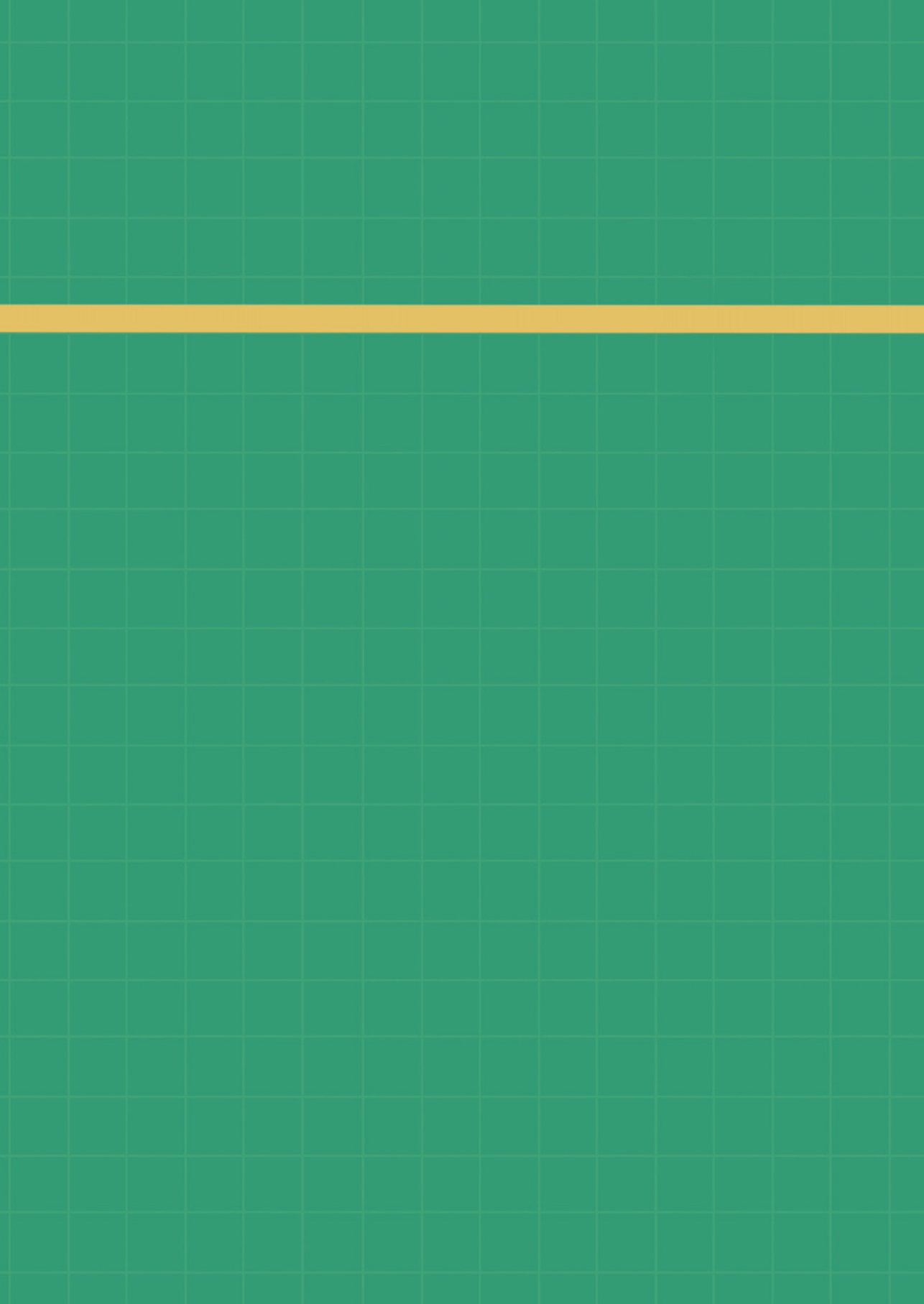


strongly related to social anxiety than likeability status. This finding supported the theoretical framework of Gilbert & Trower (2001), suggesting that social anxiety is mostly related to issues with dominance and power, and less so with affiliative relationships (Aderka et al., 2009; Gilbert & Trower, 2001; Weisman et al., 2011). Besides, it has proven necessary to distinguish different symptom clusters of social anxiety (i.e., cognitive versus behavioural symptoms) as they were differently related to social status. Specifically, behavioural avoidance was related to obtaining a low-status position in the peer group, while merely the experience of cognitive symptoms was not. There seems to be a negative perpetuating cycle between lower popularity and more social withdrawal. Avoiding social situations is a rather short-term solution and may, in fact, maintain or worsen social fears (Hofmann & Hay, 2018; Wong & Rapee, 2016). This negative cycle should be interrupted to prevent more severe consequences of low social status and heightened social anxiety in the future, such as victimization and exclusion from the peer group (de Bruyn et al., 2010; Siegel et al., 2009).

Cognitive models suggest that avoidance behaviour in social anxiety is often fear-driven (Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). By reducing the underlying fears, withdrawal behaviour may subsequently be prevented. Teaching adaptive coping strategies including cognitive reappraisal and acceptance (Schäfer et al., 2017) could improve how adolescents handle social stressful situations. Cognitive Behavioural Therapy (CBT) seems to be the golden standard in the treatment of social anxiety, as it targets both emotional, cognitive as well as behavioural symptoms (Kendall et al., 2005). Results of this dissertation highlight the more central role that targeting behavioural symptoms should receive in treating SAD. This could be concluded based on the finding that especially behavioural symptoms were related to social status, while cognitive symptoms were less important. One efficient way of preventing social avoidance is via the use of exposure therapy. During exposure therapy, individuals suffering from social anxiety are repeatedly exposed to fearful stimuli while being in controlled settings. Exposure therapy for socially anxious individuals includes for instance the following social situations: smile and say hello to someone, ask someone for the time or directions, and make small talk with someone. By doing so, their fears decrease (or at best: extinguish), because the individual experiences that the anticipated negative interpretations around the fearful stimuli are incorrect (Powers et al., 2010). Previous studies supported this idea, as exposure *in vivo* is

found to be as effective as cognitive therapy and might be the most cost-effective intervention for social anxiety disorder (Powers et al., 2008). Although CBT already includes exposure exercises, protocols that emphasize exposure even more, have the potential to improve treatment efficacy and effectiveness (Whiteside et al., 2020).

This dissertation focused on the separate contribution of two important risk factors of youth social anxiety: maladaptive cognitive biases and low social status. Ultimately, these two risk factors need to be simultaneously investigated in a dynamic longitudinal integrative framework to understand the interplay between cognitive biases and social status in social anxiety. Developing and testing such a framework would contribute to a better understanding of the onset and maintenance of social anxiety in adolescence and would provide insights into the working mechanisms informing possible prevention and treatment programs for social anxiety.



# English summary

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Social anxiety disorder (SAD) is one of the most common psychological problems among youth and the onset often takes place during adolescence. SAD is characterized by the debilitating and persistent fear of social and performance situations in which individuals are afraid to be judged negatively, embarrassed, or humiliated. SAD is also accompanied by behavioural symptoms such as the avoidance of and withdrawal from social situations (American Psychiatric Association, 2013). Individuals with increased social anxiety are known to experience functional impairments at work or school (e.g., they retrieve lower grades, fail a year, or drop-out of school early). They also have more often difficulties with relationships with friends, family, colleagues, or romantic partners, and have an increased risk of peer victimization.

When left untreated, SAD often follows a chronic pattern, with lifelong experience of symptoms. It would thus be optimal to prevent feelings of social anxiety from exacerbating to a clinical level and to effectively treat individuals with SAD. Unfortunately, the availability of selective prevention programs is limited (except for Aune & Stiles, 2009) and the current treatments, especially for youth, are questionable as they fail to effectively diminish SAD symptoms (Cartwright-Hatton et al., 2004; Hudson et al., 2015). Possibly, these limited effects are due to the fact that SAD is still one of the least researched and treated mental disorders and its theoretical foundations are not well understood. The **overarching goal** of this dissertation was therefore to better understand which factors contribute to the development and maintenance of social anxiety in adolescence. Specifically, two risk factors were examined: cognitive biases and social status.

## **THE ROLE OF COGNITIVE BIASES IN SOCIAL ANXIETY**

Many different cognitive theories assume that cognitive biases play an important role in the onset and development of social anxiety (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). However, longitudinal evidence is limited, making it difficult to draw any conclusions about the predictive impact of cognitive biases on social anxiety. Attention bias and interpretation bias are the most consistently detected biases playing a role in social anxiety. Negative attention bias is the automatic tendency to direct attention toward potentially threatening stimuli in the environment, such

as angry-looking peers. It consists of the fast detection of threat (i.e., enhanced engagement to threat), and/or the difficulty to withdraw one's attention from threat (i.e., the slow disengagement from threat). Negative interpretation bias entails the tendency to interpret ambiguous social situations in a negative way.

Attention bias and interpretation bias in social anxiety are often studied separately. However, the Combined Cognitive Bias Hypothesis (CCBH; Hirsch et al., 2006) suggests that different biases do not operate in isolation, but are rather interrelated and directly influence each other. More negative attention bias is related to more negative interpretation bias, and vice versa. In addition, the impact of the combination of biases may be larger than the impact of individual biases. A formal test of the CCBH for social anxiety in adolescents is yet to be provided.

**Chapter 2** therefore focused on studying the longitudinal relationship between attention bias (i.e., enhanced engagement to threat and slow disengagement from threat), interpretation bias, and social anxiety during three years of adolescence. In total 816 adolescents between 11-16 years old participated in this study. None of the attention bias indices predicted social anxiety in any of the grades. More negative interpretation bias in grade 7 predicted an increase in social anxiety symptoms in grade 8. Interpretation bias in grade 8, however, did not predict social anxiety in grade 9. Finally, no support was found for the CCBH: attention bias and interpretation bias were not longitudinally related, nor did they interact with each other in predicting social anxiety. Taken together, the results of Chapter 2 suggest that interpretation bias rather than attention bias is associated with the increase in social anxiety over time. The CCBH was not confirmed, rather our results suggested that different cognitive biases operate independently.

In the study of Chapter 2 and in most other studies, attention bias is measured using tasks with visual stimuli (e.g., pictures of emotional faces), while interpretation bias is typically assessed with verbal tasks (e.g., verbal vignettes of social ambiguous scenarios). The use of visual versus verbal stimuli may have complicated the possibility to investigate the supposed link between different cognitive biases. Thus, there is a need for similar cognitive bias tasks to assess both attention bias as well as interpretation bias. This will allow for a better investigation of the link between different biases and the testing of the CCBH.

In the study described in **Chapter 3**, an attempt has therefore been made to develop a new social picture task to assess interpretation bias (the Schloss

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Einstein-Radboud Social Ambiguous Images [SERSAI] task). In this task, 35 pictures of socially ambiguous scenarios were presented. Each scenario was accompanied by a positive and negative interpretation of the scenario. In the study it was tested how the SERSAI task was related to a well-established and often used interpretation bias task and to social fears in adolescents. In total 329 adolescents between 12-18 years old participated.

The two interpretation bias tasks correlated to each other, providing evidence that they measure the same underlying concept and that the newly developed pictorial was thus able to assess interpretation bias in adolescents. This is the first proof of convergent validity of the SERSAI task. The SERSAI task was able to detect a more pronounced negative interpretation bias for adolescents with higher fear of specifically negative evaluation but not for adolescents with a higher level of social anxiety as assessed with a more general measure. This result implied that the SERSAI task was able to measure the more cognitive and emotional components of social anxiety, but not to detect more general symptoms of social anxiety, including physical and behavioural social anxiety symptoms as well. Contrary, using the traditional verbal task, we did find a negative interpretation bias for adolescents with a heightened fear of negative evaluation and with higher social anxiety symptoms in general. The traditional verbal task is currently therefore still the preferred method to investigate interpretation bias related to social fears in adolescents. However, with further improvement of the pictorial task, this could be a useful addition to the research field, especially if one is specifically interested in the link between attention bias and interpretation bias. The SERSAI task is namely more related to traditional attention bias tasks, which often use pictorial stimuli as well.

## **THE ROLE OF SOCIAL STATUS IN SOCIAL ANXIETY**

Social status in the peer context has also been identified as a crucial aspect in the development of social anxiety in adolescence. Social status can be divided into popularity, linked to dominance, power, and visibility; and likeability reflecting aspects such as affiliation, intimacy, and support. Popularity and likeability are distinct concepts: popular adolescents are not necessarily the well-liked classmates, and well-liked adolescents are not automatically popular.

Three different models explain the interplay between social status and social anxiety (Kochel et al., 2012; Sentse et al., 2017). First, the interpersonal risk model assumes that low social status increases the risk of social anxiety because social anxiety mostly arises if the social environment is negative or when social relationships are conflicting and unsupportive. Second, the symptoms-driven model suggests that socially anxious adolescents are responsible for, at least to some extent, a low social status themselves. This is due to their poor social skills, the self-selection of maladaptive friendships, or because they behave in such a way that makes them an easy target for victimization. Finally, the transactional model suggests that social status and social anxiety are bidirectionally related to each other. Social anxiety triggers negative peer relationships, which in turn increase feelings of social anxiety.

The link with social anxiety may be larger for popularity than for likeability. Socially anxious individuals have relatively low self-esteem and consider themselves inferior to their peers. They actively try to avoid harm, rejection, or being passed over by peers by behaving in a submissive and appeasing way. As a result of this behaviour, socially anxious adolescents often acquire a low popularity status. The likeability status of socially anxious individuals may be less affected, because their submissive and appeasing behaviour may not damage the ability to initiate and maintain friendships. Another reason why popularity would be more strongly related to social anxiety than likeability is because unpopularity is more socially threatening than being disliked. Often the entire peer group agrees on the unpopularity status of individuals. However, if an adolescent is generally disliked by others, they may still have some friends, and having friendships is a well-known protective factor against developing social anxiety. There is also reason to assume that the link between behavioural symptoms of social anxiety and social status components is stronger than the link between cognitive symptoms and social status. This is because behavioural symptoms are observable to peers, while cognitive symptoms are not. The impact of socially anxious behaviour on peer relationships, including social status, is more direct and stronger than the impact of cognitive symptoms.

The studies described in **Chapters 4 and 5** aimed to obtain a more detailed understanding of the longitudinal relationship between specific social status components (i.e., likeability and popularity) and social anxiety symptoms (i.e.,



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cognitive and behavioural symptoms). Both directions of the relationship between social status and social anxiety are investigated in one model, hence testing the applicability of the transactional model. Additionally, gender differences in these associations were explored. In **Chapter 4** this was investigated during one school year by including two measurement waves with a 6-months interval. In total 274 adolescents between 11-15 years old participated. Social status was assessed by peer nominations and a self-report questionnaire was used to measure social anxiety symptoms. In **Chapter 5** this relationship was examined during a larger developmental period of three consecutive years, with a larger and slightly older group (1741 participants, 11-17 years old). Social status components and cognitive symptoms of social anxiety were assessed in a similar way as in Chapter 4. However, in Chapter 5, peer nominations were used to get a more objective indication of adolescents' behavioural anxiety symptoms.

Both studies confirmed that, in general, the cross-sectional relationships between both social anxiety symptoms and popularity were stronger than the associations between cognitive and behavioural social anxiety symptoms and likeability. In addition, social status components were more strongly related to behavioural social anxiety symptoms than to cognitive symptoms. Regarding the longitudinal results, Chapter 4 only found that lower levels of popularity predicted an increase in socially anxious behaviour. Chapter 5 replicated this finding but also supported the other direction of this relationship, in which more withdrawal behaviour predicted lower popularity levels at a later time point. Chapter 5 also showed that more socially anxious behaviour predicted being less liked by peers. Finally, the study of Chapter 5 found that both a lower popularity status and being more liked by peers resulted in more cognitive symptoms of social anxiety. This final result was quite unexpected but could indicate that highly liked adolescents are maybe more concerned by maintaining their likeability status, predicting increased social fear. Also, it can be argued that being afraid to be negatively evaluated by others is part of the profile of highly liked individuals.

Evidence regarding gender differences in the association between peer relations and social anxiety is rather inconclusive: Chapter 5 found no gender differences, but Chapter 4 concluded that a longitudinal link from popularity to behavioural social anxiety symptoms was only present for girls but not boys. The difference in findings between both chapters could be explained by the different methodologies

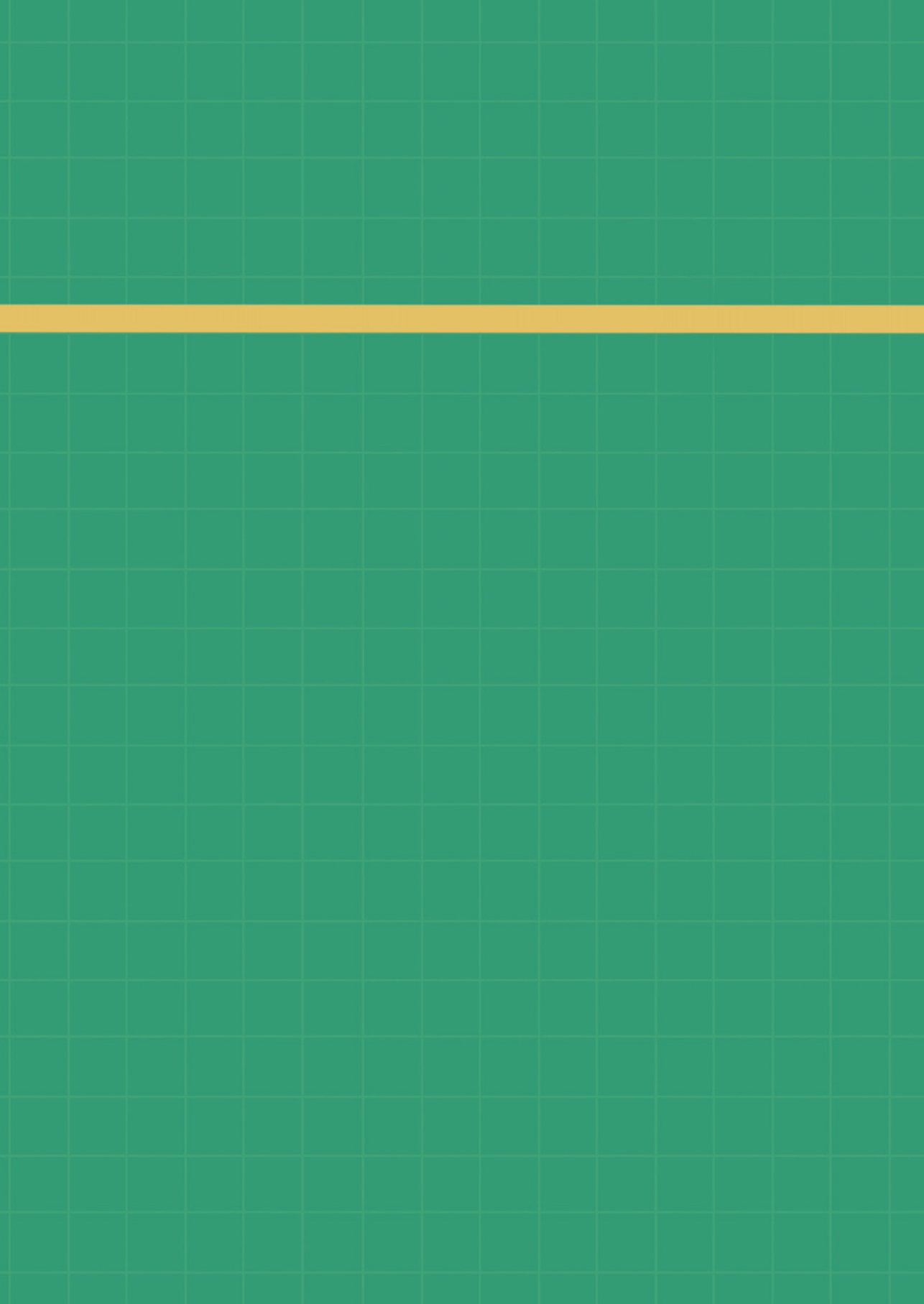
(e.g., the time frame, sample size, age of the participants, and the measure and operationalization of behavioural social anxiety symptoms).

Taking all findings together, Chapter 4 only provided evidence for the interpersonal risk model (as low popularity predicted socially anxious behaviour but not vice versa) while Chapter 5 found support for the transactional model. Social status and social anxiety may influence each other in a bidirectional way, together constituting a vicious cycle. However, the strength of this link is largely dependent upon the subcomponents and symptom types under investigation. The link is least apparent for cognitive social anxiety symptoms and likeability status and most apparent for behavioural symptoms and popularity.

## CONCLUSION

The studies described in this dissertation aimed to better understand the development of social anxiety in adolescence, by gaining more insight into the role of cognitive biases and social status as possible risk factors in a longitudinal perspective. Taken together all results of the studies of this dissertation, it can be concluded that social status (both likeability and popularity) and interpretation bias are contributing factors to social anxiety in adolescence. Our studies do not support the importance of attention bias for youth social anxiety, but this should be further investigated. Specifically, methodological difficulties with the assessment of attention bias might be the underlying reason for the lack of findings. Future research should attempt to enhance existing tasks or develop new and improved methods.

The aim of the current dissertation focused on the separate contribution of the role of cognitive biases (Chapters 2 and 3) and social status (Chapters 4 and 5) on social anxiety. In line with Bronfenbrenner's ecological theory, there is probably an ongoing interaction between both cognitive biases and social status (Bronfenbrenner & Morris, 2006). Future research should therefore focus on integrating both risk factors in one model and examine their dynamic interplay in the onset and maintenance of social anxiety. This will allow for a more integrative and comprehensive understanding of individual (i.e., cognitive biases) and contextual (i.e., social status) risk factors of social anxiety in adolescence.



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**Dutch summary**  
*Nederlandse samenvatting*

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Sociale angststoornis (SAS) is één van de meest voorkomende psychische problemen bij jongeren en begint vaak tijdens de adolescentie. SAS wordt gekenmerkt door een extreme en aanhoudende angst voor sociale situaties waarin mensen bang zijn om negatief te worden beoordeeld, in verlegenheid te worden gebracht of om te worden vernederd. SAS gaat ook gepaard met gedragssymptomen zoals het vermijden van sociale situaties (American Psychiatric Association, 2013). Van individuen met verhoogde sociale angst is bekend dat ze problemen ervaren op werk of school (bijv. ze halen lagere cijfers, moeten een jaar blijven zitten, of verlaten school vroegtijdig). Ook ervaren ze vaker problemen in relaties met vrienden, familie, collega's, of liefdespartners en hebben ze een verhoogd risico om gepest te worden.

Wanneer SAS niet behandeld wordt, volgt het vaak een chronisch patroon met levenslange symptomen. Het zou dus optimaal zijn om te voorkomen dat gevoelens van sociale angst verergeren tot een klinisch niveau en om individuen met SAS effectief te behandelen. Helaas is de beschikbaarheid van selectieve preventieprogramma's beperkt (met uitzondering van Aune & Stiles, 2009) en zijn de huidige behandelingen, vooral voor jongeren, twijfelachtig omdat ze er niet in slagen symptomen effectief te verminderen (Cartwright-Hatton et al., 2004; Hudson et al., 2015). Mogelijk zijn deze beperkte effecten te wijten aan het feit dat SAS nog steeds één van de minst onderzochte en behandelde psychische stoornissen is en de theoretische grondslagen ervan nog onduidelijk zijn. Het **overkoepelende doel** van dit proefschrift was daarom om beter te begrijpen welke factoren bijdragen aan de ontwikkeling en instandhouding van sociale angst in de adolescentie. Specifiek werden twee risicofactoren onderzocht: cognitieve biases en sociale status.

## DE ROL VAN COGNITIEVE BIASES IN SOCIALE ANGST

Veel verschillende cognitieve theorieën gaan ervan uit dat cognitieve biases een belangrijke rol spelen bij het ontstaan en de ontwikkeling van sociale angst (Beck et al., 2005; Beck & Clark, 1997; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Spence & Rapee, 2016). Het longitudinale bewijs is echter beperkt, waardoor het moeilijk is om conclusies te trekken over de voorspellende invloed van cognitieve biases op sociale angst. Cognitieve biases worden ook wel omschreven

als cognitieve vertekeningen. Biases in de aandacht en interpretatie zijn de belangrijkste biases die een rol spelen bij sociale angst. Negatieve aandachtsbias is de automatische neiging om de aandacht te richten op potentieel bedreigende stimuli in de omgeving, zoals booslijkende leeftijdgenoten. Het bestaat uit de snelle ontdekking van dreiging en/of de moeilijkheid om de aandacht van dreiging af te wenden. Negatieve interpretatiebias wordt omschreven als de neiging om dubbelzinnige sociale situaties op een negatieve manier te interpreteren.

Aandachtsbias en interpretatiebias bij sociale angst worden vaak afzonderlijk bestudeerd. De 'Combined Cognitive Bias Hypothesis' (CCBH; Hirsch et al., 2006) suggereert echter dat verschillende biases niet onafhankelijk zijn, maar eerder onderling samenhangen en elkaar rechtstreeks beïnvloeden. Een negatievere aandachtsbias hangt samen met een negatievere interpretatiebias, en vice versa. Bovendien kan het effect van de combinatie van biases groter zijn dan het effect van individuele biases. Een formele test van de CCBH voor sociale angst bij adolescenten is echter nog niet uitgevoerd.

**Hoofdstuk 2** richtte zich daarom op het bestuderen van de longitudinale relatie tussen aandachtsbias (d.w.z. snelle ontdekking van dreiging en de moeilijkheid om de aandacht van dreiging af te wenden), interpretatiebias, en sociale angst gedurende drie jaar tijdens de adolescentie. In totaal namen 816 middelbare scholieren tussen 11-16 jaar deel aan deze studie. Geen van de aandachtsbiascomponenten voorspelde sociale angst over de tijd heen. Meer negatieve interpretatiebias in de brugklas voorspelde een toename van sociale angstsymptomen in de tweede klas. Interpretatiebias in de tweede klas voorspelde echter geen sociale angst in de derde klas van de middelbare school. Tenslotte werd er geen ondersteuning gevonden voor de CCBH: aandachtsbias en interpretatiebias hingen niet longitudinaal met elkaar samen, noch interacteerden ze met elkaar in het voorspellen van sociale angst. Alles bij elkaar suggereren de resultaten van Hoofdstuk 2 dat interpretatiebias, maar niet aandachtsbias, geassocieerd is met de toename van sociale angst in de loop van de tijd. De CCBH werd niet bevestigd, maar onze resultaten suggereerden dat verschillende cognitieve biases onafhankelijk van elkaar werken.

In het onderzoek van Hoofdstuk 2 en in de meeste andere onderzoeken, wordt aandachtsbias gemeten met behulp van taken met visuele stimuli (bijv. plaatjes van emotionele gezichten), terwijl interpretatiebias wordt gemeten met tekstuele taken

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(bijv. tekstuele vignetten van sociale dubbelzinnige scenario's). Het gebruik van visuele versus tekstuele stimuli kan het moeilijker hebben gemaakt om een verband te vinden tussen de verschillende cognitieve biases. Daarom is het noodzakelijk dat er vergelijkbare taken worden ontwikkeld om zowel aandachtsbias als interpretatiebias te meten. Dit gaat ervoor zorgen dat het verband tussen verschillende biases beter onderzocht kan worden en dat de CCBH beter kan worden getest.

In het onderzoek beschreven in **Hoofdstuk 3**, is daarom een poging gedaan om een nieuwe sociale taak met afbeeldingen te ontwikkelen om interpretatiebias te meten (de Schloss Einstein-Radboud Social Ambiguous Images [SERSAI]-taak). In deze taak werden 35 afbeeldingen van dubbelzinnige sociale scenario's gepresenteerd. Elk scenario ging gepaard met een positieve en negatieve interpretatie van het scenario. In het onderzoek werd getest hoe de SERSAI-taak zich verhiel tot een gerenommeerde en vaak gebruikte interpretatiebias-taak en tot sociale angst bij jongeren. In totaal namen 329 adolescenten tussen 12-18 jaar deel aan het onderzoek.

De twee interpretatiebias-taken hingen met elkaar samen, wat bewijst dat ze hetzelfde onderliggende concept meten en dat de nieuw ontwikkelde taak dus in staat was om interpretatiebias bij adolescenten te meten. Dit is het eerste bewijs van convergente validiteit van de SERSAI-taak. De SERSAI-taak was in staat om een negatieve interpretatiebias te detecteren bij adolescenten met een hogere angst voor negatieve beoordelingen van anderen, maar niet bij adolescenten met een hoger niveau van sociale angst in het algemeen. Dit betekende dat de SERSAI-taak in staat was om de meer cognitieve en emotionele componenten van sociale angst te meten, maar niet om meer algemene symptomen van sociale angst te detecteren, waaronder ook fysieke en gedragsmatige sociale angstsymptomen. Daarentegen vonden we met de tekstuele taak wel een negatieve interpretatiebias bij adolescenten met een verhoogde angst voor negatieve evaluatie en met hogere sociale angstsymptomen in het algemeen. De traditionele tekstuele taak is daarom op dit moment nog steeds de voorkeursmethode om interpretatiebias gerelateerd aan sociale angst bij adolescenten te onderzoeken. Echter, met verdere verbetering van de SERSAI-taak, zou het een nuttige aanvulling kunnen zijn op het onderzoeksveld, vooral als men specifiek geïnteresseerd is in het verband tussen aandachtsbias en interpretatiebias, aangezien de SERSAI-taak meer verwant is aan traditionele aandachtsbiastaken, die vaak ook gebruik maken van visuele stimuli.

## DE ROL VAN SOCIALE STATUS IN SOCIALE ANGST

Sociale status in de context van leeftijdgenoten is ook geïdentificeerd als een cruciaal aspect in de ontwikkeling van sociale angst in de adolescentie. Sociale status kan worden onderverdeeld in hoe populair iemand is, gekoppeld aan dominantie, macht en zichtbaarheid en in hoe aardig iemand wordt gevonden (ook wel 'geliefdheid' genoemd), dat aspecten weerspiegelt als verbondenheid, intimiteit en steun. Populariteit en geliefdheid zijn verschillende concepten: populaire adolescenten zijn niet noodzakelijk de meest geliefde klasgenoten, en adolescenten die geliefd zijn, zijn niet automatisch populair.

Drie verschillende modellen verklaren de wisselwerking tussen sociale status en sociale angst (Kochel et al., 2012; Sentse et al., 2017). Ten eerste gaat het interpersoonlijke risicomodel ervan uit dat een lage sociale status het risico op sociale angst verhoogt omdat sociale angst meestal ontstaat als de sociale omgeving negatief is of als sociale relaties conflicterend en niet-ondersteunend zijn. Ten tweede suggereert het symptoom-gedreven model dat sociaal angstige adolescenten, in ieder geval tot op zekere hoogte, zelf verantwoordelijk zijn voor een lage sociale status. Dit komt door hun gebrekkige sociale vaardigheden, de zelfselectie van verkeerde vriendschappen, of omdat ze zich zo gedragen dat ze een gemakkelijk doelwit zijn voor pesten. Ten slotte suggereert het transactionele model dat sociale status en sociale angst bi-directioneel aan elkaar gerelateerd zijn. Sociale angst triggert negatieve relaties met leeftijdsgenoten, die op hun beurt gevoelens van sociale angst verhogen.

Het verband met sociale angst is mogelijk sterker voor populariteit dan voor geliefdheid. Sociaal angstige individuen hebben een relatief lage eigenwaarde en beschouwen zichzelf als inferieur aan hun leeftijdgenoten. Zij proberen actief leed, afwijzing of gepasseerd worden door leeftijdsgenoten te voorkomen door zich onderdanig en meegaand te gedragen. Als gevolg van dit gedrag hebben sociaal angstige adolescenten vaak een lage populariteitsstatus. De geliefdheidsstatus van sociaal angstige individuen wordt minder aangetast, omdat hun onderdanige gedrag het vermogen om vriendschappen te sluiten en te onderhouden niet beïnvloedt. Een andere reden waarom populariteit sterker gerelateerd zou zijn aan sociale angst dan geliefdheid, is omdat impopulariteit sociaal bedreigender is dan niet geliefd zijn. Vaak zijn alle klasgenoten het eens welke individuen niet populair zijn. Echter, als jongeren over het algemeen niet geliefd zijn bij anderen, kunnen



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zij nog steeds een aantal vrienden hebben, en het hebben van vriendschappen is een beschermende factor tegen het ontwikkelen van sociale angst. Er is ook reden om aan te nemen dat het verband tussen gedragssymptomen van sociale angst en sociale status sterker is dan het verband tussen cognitieve symptomen en sociale status. Dit komt doordat gedragssymptomen waarneembaar zijn voor leeftijdgenoten, terwijl cognitieve symptomen dat niet zijn. De invloed van sociaal angstig gedrag op relaties met leeftijdgenoten, inclusief sociale status, is directer en sterker dan de invloed van cognitieve symptomen.

De onderzoeken beschreven in **Hoofdstukken 4 en 5** hadden als doel een meer gedetailleerd inzicht te geven in de longitudinale relatie tussen specifieke sociale statuscomponenten (d.w.z. geliefdheid en populariteit) en sociale angstsymptomen (d.w.z. cognitieve en gedragssymptomen). Beide richtingen van de relatie tussen sociale status en sociale angst werden onderzocht in één model, waarmee het transactionele model werd getest. Bovendien werden genderverschillen in deze associaties onderzocht. In **Hoofdstuk 4** werd dit onderzocht gedurende één schooljaar door op twee momenten metingen uit te voeren met een interval van 6 maanden. In totaal namen 274 middelbare scholieren tussen 11-15 jaar deel aan dit onderzoek. Sociale status werd beoordeeld door nominaties van leeftijdgenoten en een zelfrapportagevragenlijst werd gebruikt om sociale angstsymptomen te meten. In **Hoofdstuk 5** werd deze relatie onderzocht gedurende een langere ontwikkelingsperiode van drie opeenvolgende jaren, met een grotere en iets oudere groep (1741 deelnemers, 11-17 jaar). Sociale statuscomponenten en cognitieve symptomen van sociale angst werden op een vergelijkbare manier gemeten als in Hoofdstuk 4. Echter, in Hoofdstuk 5 werden nominaties van leeftijdgenoten gebruikt om een meer objectieve indicatie te krijgen van de gedragsmatige angstsymptomen van adolescenten.

Beide onderzoeken bevestigden dat, in het algemeen, de cross-sectionele verbanden tussen beide sociale angstsymptomen en populariteit sterker waren dan de verbanden tussen cognitieve en gedragsmatige sociale angstsymptomen en geliefdheid. Bovendien waren sociale statuscomponenten sterker gerelateerd aan gedragsmatige sociale angstsymptomen dan aan cognitieve symptomen. Wat betreft de longitudinale resultaten, werd in Hoofdstuk 4 alleen gevonden dat lagere niveaus van populariteit een toename in sociaal angstig gedrag voorspelden. Hoofdstuk 5 repliceerde deze bevinding, maar ondersteunde ook

de andere richting van deze relatie, waarin meer vermijdingsgedrag een lager populariteitsniveau voorspelde op een later tijdstip. Hoofdstuk 5 toonde ook aan dat meer sociaal angstig gedrag voorspelde dat men minder geliefd gevonden werd door leeftijdsgenoten. Tenslotte bleek uit de studie van Hoofdstuk 5 dat zowel een lagere populariteitsstatus als een hogere geliefdsheidsstatus resulteerden in meer cognitieve symptomen van sociale angst. Dit laatste resultaat was onverwacht, maar zou erop kunnen wijzen dat geliefde adolescenten zich misschien meer zorgen maken over het behoud van hun geliefdheidsstatus, wat een grotere sociale angst voorspelt. Ook kan het zijn dat de angst om negatief geëvalueerd te worden door anderen deel uitmaakt van de persoonlijkheid van zeer geliefde individuen.

Het bewijs voor sekseverschillen in het verband tussen relaties met leeftijdgenoten en sociale angst is weinig overtuigend: in Hoofdstuk 5 werden geen sekseverschillen gevonden, maar in Hoofdstuk 4 werd geconcludeerd dat een longitudinaal verband tussen populariteit en gedragsmatige sociale angstsymptomen alleen bij meisjes maar niet bij jongens aanwezig was. Het verschil in bevindingen tussen beide hoofdstukken zou verklaard kunnen worden door de verschillende methodologieën (bv., het tijdsbestek, de steekproefgrootte, de leeftijd van de deelnemers en de methode en operationalisering van gedragsmatige sociale angstsymptomen).

Alle bevindingen bij elkaar genomen, leverde Hoofdstuk 4 alleen bewijs voor het interpersoonlijke risicomodel (lage populariteit voorspelde sociaal angstig gedrag, maar niet andersom), terwijl Hoofdstuk 5 ondersteuning gaf voor het transactionele model. Sociale status en sociale angst beïnvloeden elkaar op een bidirectionele manier en vormen samen een vicieuze cirkel. De sterkte van dit verband is echter grotendeels afhankelijk van de onderzochte subcomponenten en symptoomtypen. Het verband is het minst duidelijk voor cognitieve sociale angstsymptomen en geliefdheidsstatus en het duidelijkst voor gedragssymptomen en populariteit.

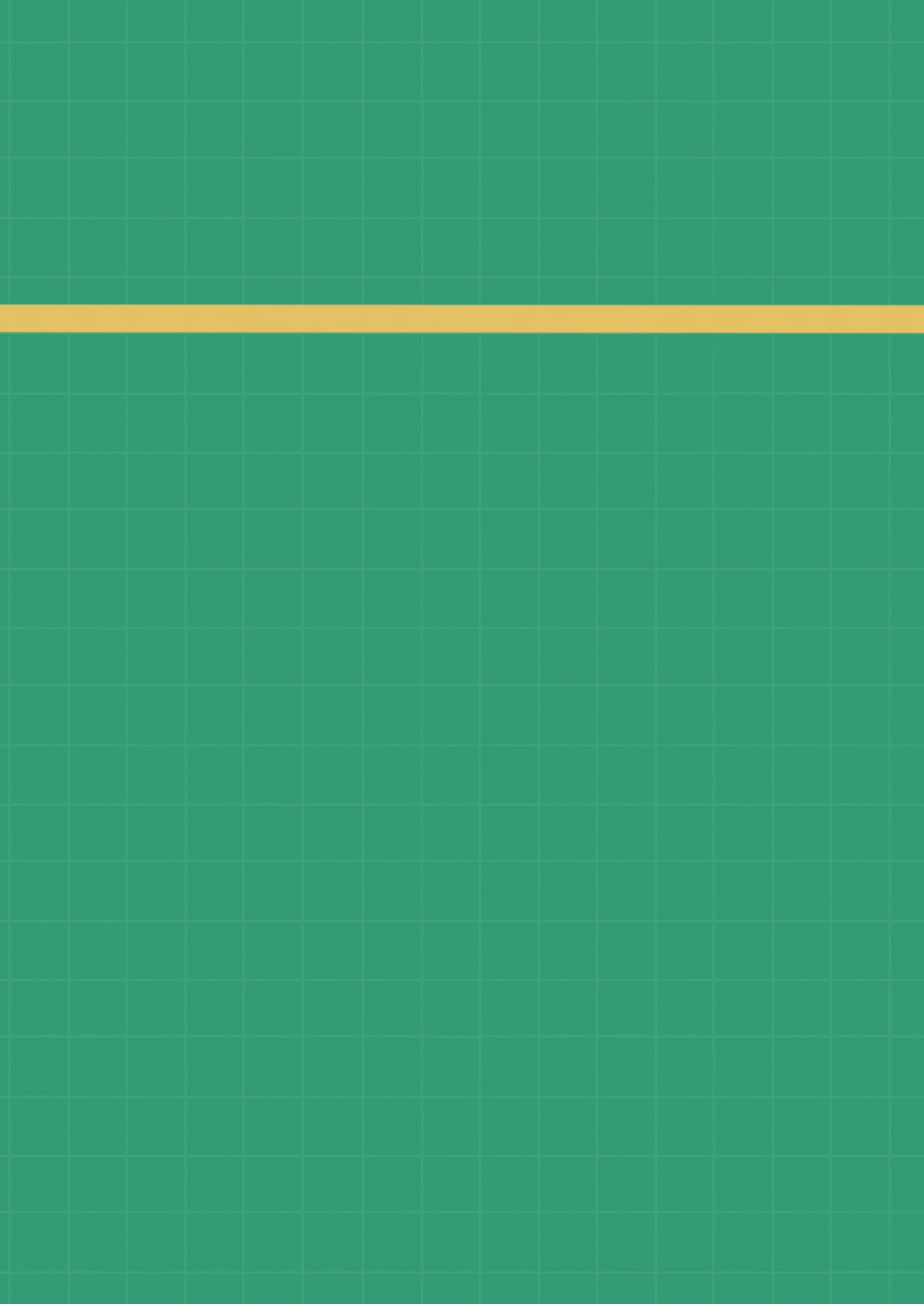
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## CONCLUSIE

Dit proefschrift had tot doel de ontwikkeling van sociale angst in de adolescentie beter te begrijpen, door meer inzicht te krijgen in de rol van cognitieve biases en sociale status als mogelijke risicofactoren in een longitudinaal perspectief. Met alle resultaten van de onderzoeken in dit proefschrift bij elkaar genomen, kan er geconcludeerd worden dat sociale status (zowel geliefdheid als populariteit) en interpretatiebias bijdragen aan sociale angst in de adolescentie. Deze onderzoeken ondersteunen niet het belang van aandachtsbias voor sociale angst bij jongeren, maar dit zal verder onderzocht moeten worden. Met name methodologische problemen bij het vaststellen van aandachtsbias zou de onderliggende reden kunnen zijn voor het gebrek aan bevindingen. Toekomstig onderzoek zal moeten proberen om bestaande taken te verbeteren of nieuwe en verbeterde methoden te ontwikkelen.

De onderzoeken van het huidige proefschrift richtten zich op de afzonderlijke bijdrage van de rol van cognitieve biases (Hoofdstukken 2 en 3) en sociale status (Hoofdstukken 4 en 5) op sociale angst. In lijn met de ecologische theorie van Bronfenbrenner is er waarschijnlijk een voortdurende interactie tussen zowel cognitieve biases als sociale status (Bronfenbrenner & Morris, 2006). Toekomstig onderzoek moet zich daarom richten op het integreren van beide risicofactoren in één model en hun dynamische wisselwerking onderzoeken bij het ontstaan en in stand houden van sociale angst. Dit zal leiden tot een meer integraal en omvattend begrip van individuele (d.w.z. cognitieve biases) en contextuele (d.w.z. sociale status) risicofactoren van sociale angst in de adolescentie.





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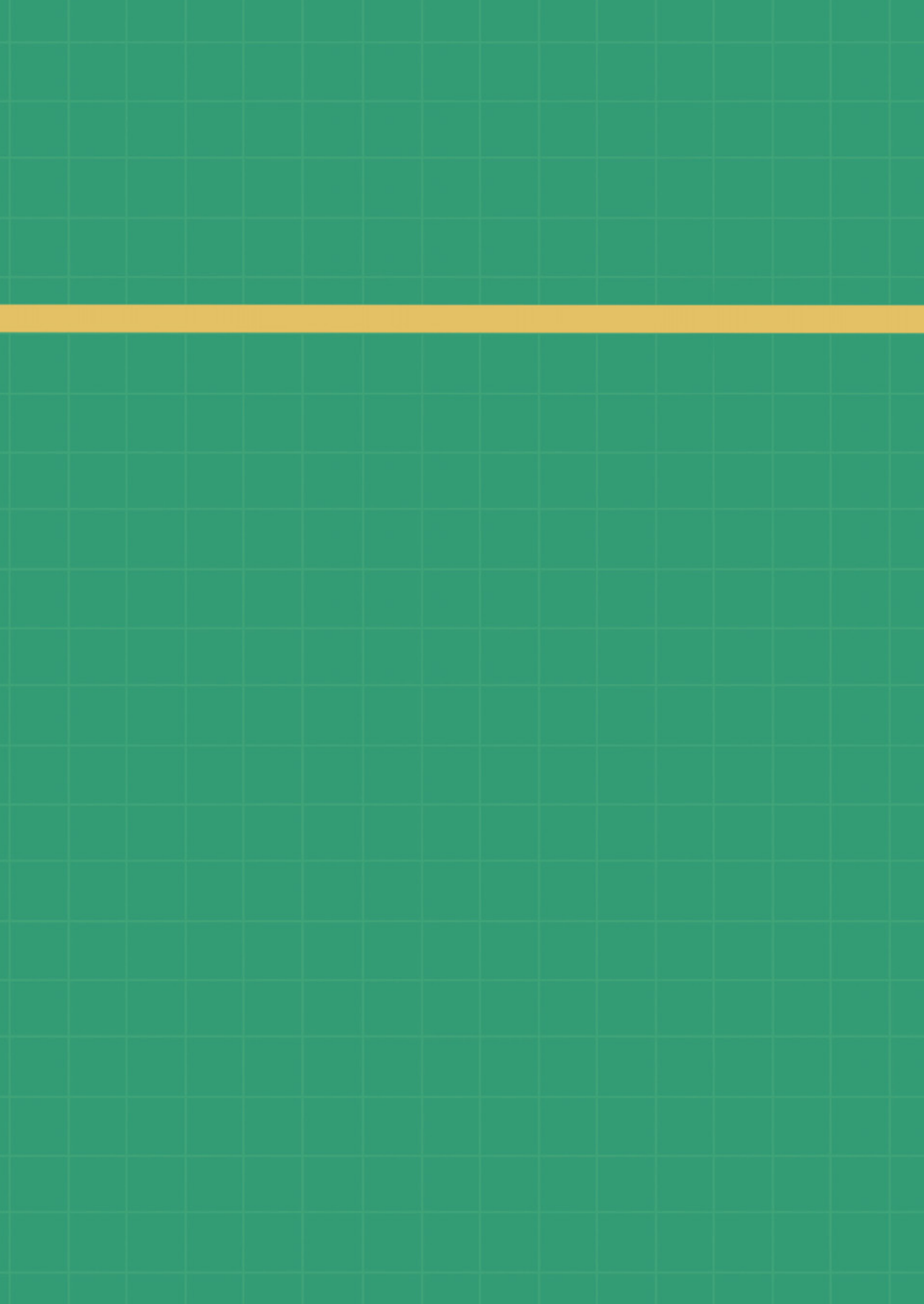
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# Data management and transparency



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The Radboud University and the Behavioural Science Institute (BSI) have set strict conditions for the management of research data. All research data from the studies conducted for this dissertation were handled in accordance with the university's research data management policy (<https://www.ru.nl/rdm/>) and the General Data Protection Regulation (GDPR; <https://www.ru.nl/privacy/english/protection-personal-data/general-data-protection-regulation-gdpr/>).

To enhance open science and transparent research practices, I preregistered the studies of Chapter 2 and Chapter 3 on the Open Science Framework. In addition, for the studies of Chapter 2, Chapter 3, Chapter 4, and Chapter 5 all anonymized data, analysis scripts, output files and, if possible, accompanying research materials are available on the Open Science Framework.

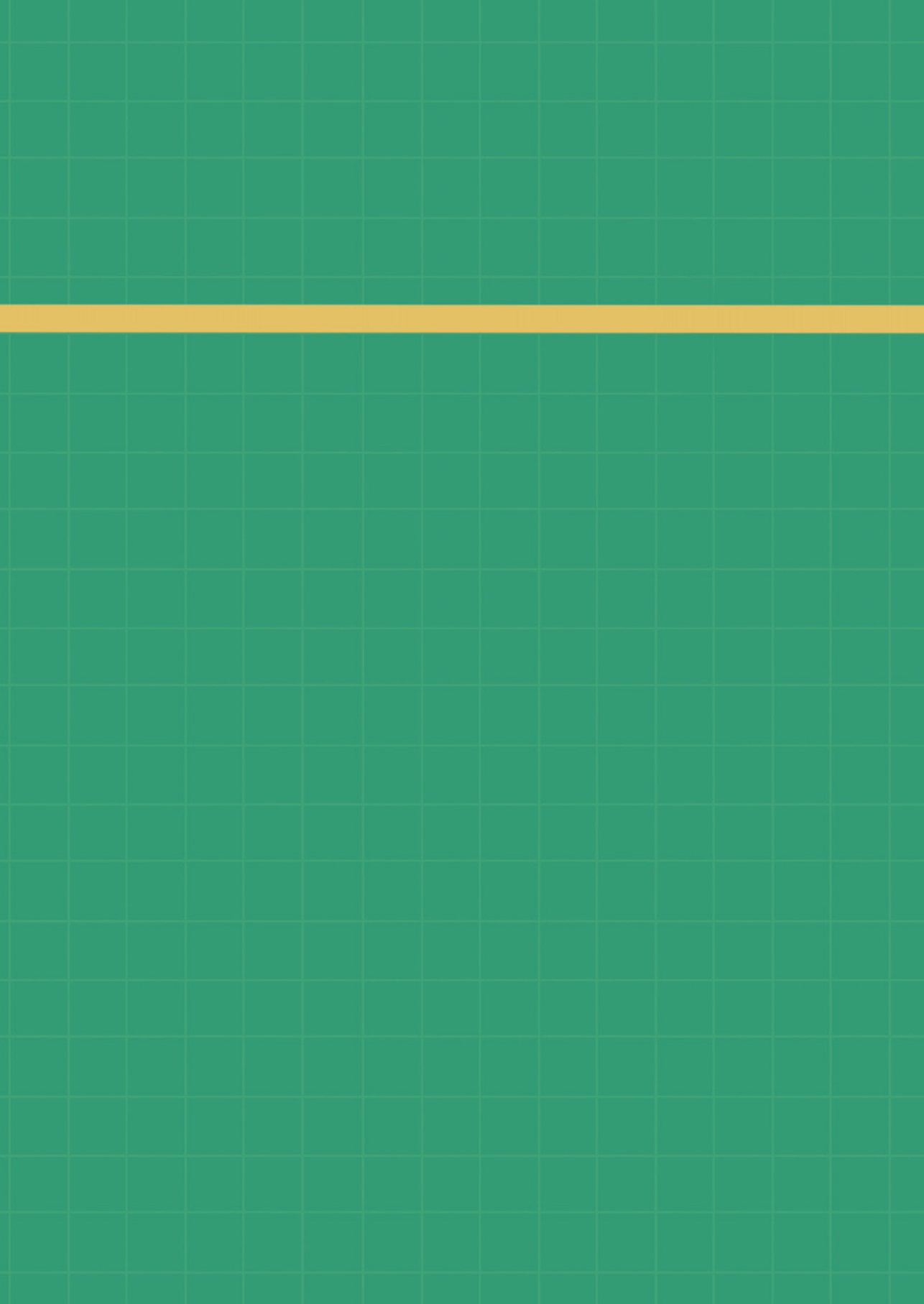
The links to the Open Science Framework for each chapter are:

Chapter 2: <https://osf.io/xq25b/>

Chapter 3: <https://osf.io/b35da/>

Chapter 4: <https://osf.io/g4awq/>

Chapter 5: <https://osf.io/afbp9/>



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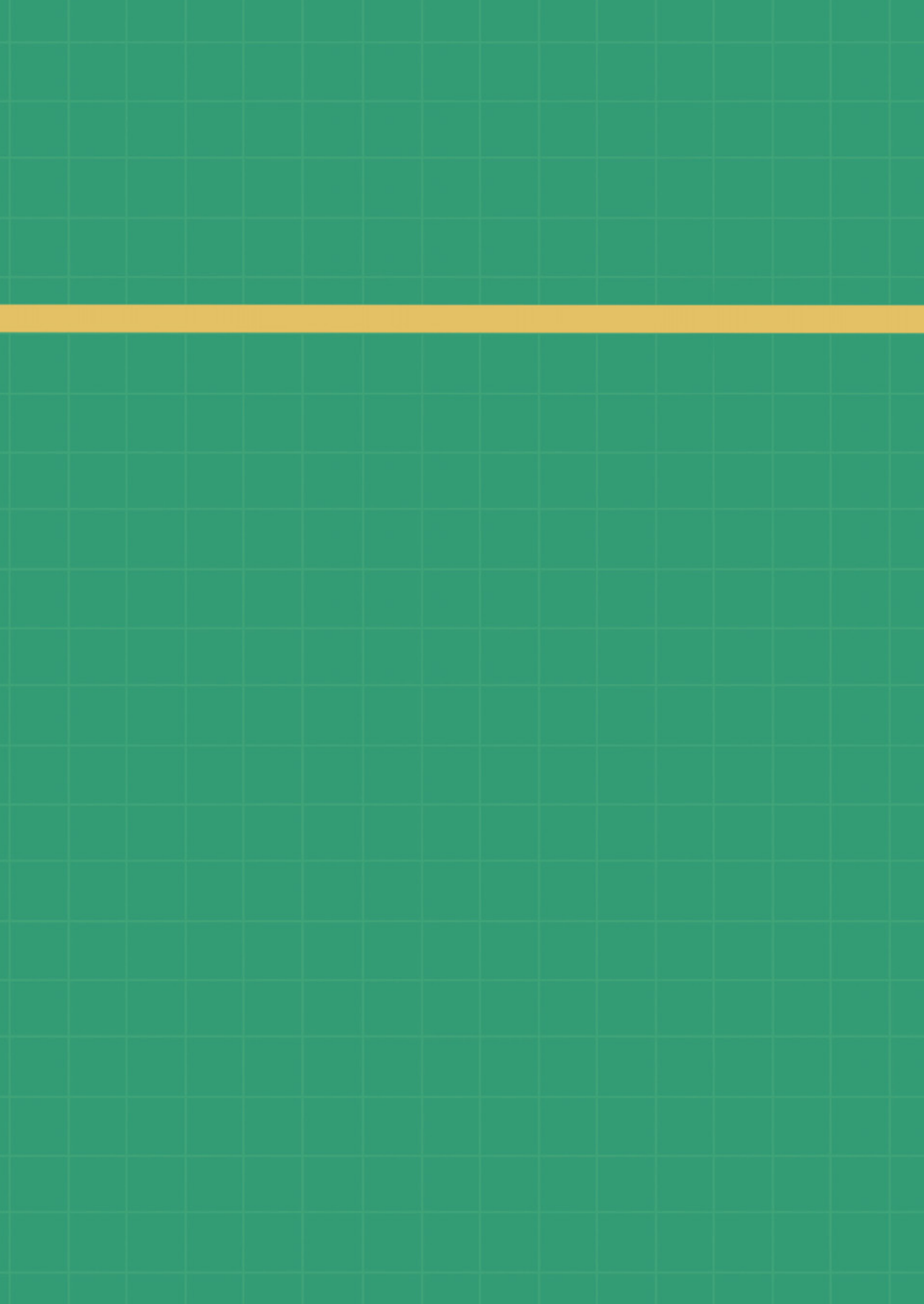
## About the author

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Lisan Henricks was born on January 21, 1992 in Utrecht, the Netherlands. After completing her secondary education at St. Bonifatiuscollege in Utrecht, she started studying Pedagogical Sciences at Utrecht University in 2010. In 2014 she obtained her bachelor's degree. During her bachelor, Lisan was active in a student association (UMTC), including a board year as president of the executive board. In 2016, she



graduated *cum laude* from the research master Development and Socialisation in Childhood and Adolescence at Utrecht University. During her master thesis project she examined the transactional relationship between attention bias, interpretation bias and social anxiety in children. For her thesis she was supervised by dr. Jorg Huijding, dr. Samantha Bouwmeester and prof. dr. Maja Deković. Driven by the interest in this research topic, Lisan started her PhD project at the Behavioural Science Institute of Radboud University in September 2016 under supervision of dr. Wolf-Gero Lange, dr. Maartje Luijten and prof. dr. Eni Becker. She investigated the development of social anxiety symptoms in adolescence and examined the contributing role of social status and cognitive biases in this. The result of this project is the present dissertation. Since November 2021, Lisan is working as a lecturer at the Department of Youth & Family of the Faculty of Social and Behavioural Sciences, Utrecht University.



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# Acknowledgements

*Dankwoord*



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“Alone we can do so little; together we can do so much” (Helen Keller). This quote perfectly describes my PhD trajectory. I could not have successfully finished my dissertation without the help of my colleagues, friends and family. I am forever grateful for all their support.

First of all, I would like to express my gratitude to my PhD supervisors: *Eni Becker, Gero Lange & Maartje Luijten*. Thank you for all your support, guidance, and advice, both on a personal and professional level. You always gave me the confidence to make my own decisions. *Eni*, you once told me that supervising PhD students was the favorite part of your job. That was definitely noticeable for me. Your enthusiasm for coming up with new research ideas was contagious. Thank you for challenging me to think more on a theoretical and clinical level, instead of focusing only on methodological and statistical issues. Your feedback on my papers was always constructive, even though your handwriting was sometimes a puzzle. Finally, you really helped me to overcome my spider anxiety as I had to take care of your tarantula during the summer.

*Gero*, my daily supervisor, you were always interested in me as a person. Vielen Dank dass du mir immer geholfen haben mit den Deutschen Fernsehproduzenten zu kommunizieren. I enjoyed our meeting walks and coffee breaks together, and will never forget dancing the ‘polonaise’ together with you at conferences.

*Maartje*, it was great having you on board as my supervisor. I will never forget the thing you said during one of our first meetings; “You should only do research on topics that you are interested in, and not what we as supervisors want you to do. It is your PhD project, not ours.” Your expertise on doing research with adolescents was really helpful. Thank you for all the practical help with the data collection and your pragmatic point of view on research.

My sincere gratitude to the *members of the manuscript and the defense committee*. In particular, I would like to thank *Jorg Huijding* as your enthusiasm during my master thesis sparked my interest for studying cognitive biases in youth. Thank you for providing feedback on my research proposal that led to this PhD project. I am looking forward to working together as colleagues at Utrecht University.

My PhD time would not be the same without my *colleagues from the Experimental Psychopathology and Treatment department*. Thank you for all the fun activities

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during the annual days out, the Christmas dinners (which always involved a lot of singing), the monthly colloquia, the lunches at 'de Refter' and the table tennis tournaments. It was a pleasure to work with you at the '7<sup>th</sup> floor'.

Furthermore, a special thanks to all the past and current *members of the Cognitive Processes, Psychopathology and Treatment (CogPT) labgroup*. Having meetings with you on Friday afternoons was always fun. Thank you for thinking along with my research ideas, as your feedback really improved the studies of my dissertation. I also enjoyed the pre-corona social activities we did together: the barbecues, Wichteln evenings and writing weeks in Germany.

*Mike Rinck*, thank you for all your input on my research designs, for your preaches on statistical power and for always focusing on the details in my presentations. I will make sure to never include references in the last slide of my talks anymore.

*Zhen Zhang*, you were an amazing roommate at the office, and I enjoyed the time we spend together at the WCBCT in Berlin. You are a very kind and thoughtful colleague, and I will never forget that you send me mouth masks at the beginning of the pandemic all the way from China.

*Anna Dapprich*, we didn't see each other often these last years because of corona, and at the moment you are in New-Zealand for your PhD. However, I always enjoyed the chats we had near the coffee machine or in the office and it was really nice that we could go to the EACLIPT in Dresden together.

*Floor Burghoorn & Joppe Klein-Breteler*, thanks to you I stayed productive during and after the corona-time. Working from home together via Skype with you was really helpful and it was always nice to chat with you about work-related issues and everyday life. I look up to both of you with regards to your statistical expertise, knowledge and enthusiasm for research. I wish you the best for your PhD projects. *Floor*, I am looking forward to finally meet you in person during my defense!

To all the *members of the Peer Lab of the Social Development department*, and especially to *Toon Cillessen, Tessa Lansu, Sabine Stoltz, Yvonne van den Berg, Bill Burk, Loes Pouwels, Geert Verheijen & Desi Beckers*: thank you for adopting and welcoming me in your group. It was a pleasure to join the lab meetings and discuss various topics on child development, in particular peer relationships. I especially enjoyed the PRO-meetings and the SRA conference trip to Minneapolis together.

*Desi & Geert*: You are amazing persons and working together with you on the KLS-project was one of my favourite tasks of my PhD!

*Giovanni ten Brink*, we have spent many hours behind the computer together. Thank you for all your help with programming and processing the data of the Kandinsky Longitudinal Study. I have learned a lot from you, even if I did not always understand what you did in Inquisit.

*Rob Gommans*, thank you for your willingness to always answer my questions about GDPR and data management issues. Thanks to your tip about LastPass, I can finally remember all my passwords.

This dissertation would not have been possible without the cooperation of all adolescents, parents, teachers and school leaders. Also thanks to all student assistants for their help with data collection. In particular, I would like to thank *Chantal Kokke* for the great teamwork. *Chantal*, your passion to create a safe and supportive environment for students at high schools is inspiring.

Naast mijn collega's, ben ik ook dankbaar voor mijn vrienden en familie die mij gedurende mijn PhD project hebben gesteund en die ervoor zorgden dat ik ook een leven had buiten de wetenschap.

Ten eerste, *Aike, Anne, Fanny, Milou & Sophie*. Het is alweer een hele tijd geleden dat we elkaar leerden kennen op de middelbare school, maar ik ben ontzettend dankbaar dat we elkaar nog steeds regelmatig zien met FLAAMS. Het maakt niet uit of iemand in België, Dubai, Portugal, Australië of Zuid-Amerika woont: we vinden elkaar altijd terug! Ik heb genoten met jullie afgelopen zomer in Frankrijk, waar ik de druk van het afronden van mijn PhD even kon loslaten.

Mijn jaarclubgenootjes, *Mayke, Femke & Danielle*. Ik ben dankbaar voor jullie oneindige steun tijdens de fijne, maar ook de moeilijke momenten in mijn leven. Ik kan enorm genieten van onze gezellige en lekkere etentjes en de mooie gesprekken die we dan hebben. *Mayke*, bedankt voor al je hulp bij mijn dataverzameling. Doordat jij bereid was mijn mailtjes door te sturen naar je collega's op school, heb ik genoeg proefpersonen kunnen verzamelen. *Femke*, jij was altijd geïnteresseerd in mijn onderzoek en ik waardeerde het heel erg dat je altijd zo enthousiast doorvroeg naar mijn resultaten. *Danielle*, in het bijzonder dank voor de prachtige omslag en het design van mijn proefschrift. Ik verbaas mij

---

toch iedere keer weer hoe je het voor elkaar krijgt om zoiets moois te tekenen. En excuus voor alle pietluttige opmerkingen over komma's en paginanummers die ik schuin wilde hebben staan.

Lieve *Soundry, Kelly, Maartje, Becca & Marry*: mijn interesse voor onderzoek begon eigenlijk toen ik jullie leerden kennen tijdens onze research master DaSCA in Utrecht. Het lijkt nog niet eens zo heel lang geleden dat we met z'n allen zaten te werken aan onze scripties in het Sjoerd Groenman Gebouw, maar wat is er een hoop gebeurd de afgelopen jaren. Ik heb ontzettend genoten van alle bruiloften en vrijgezellenfeestjes die we samen hebben mogen vieren. Jammer dat iedereen ondertussen is getrouwd, maar ik kijk al uit naar alle memorabele momenten die nog zullen volgen.

*Letteke*, mijn allereerste vriendin in Nijmegen. Op een steenworp afstand woonden we van elkaar en jij was en bent mijn grootste steun. Samen praten over van alles en nog wat, samen lachen, samen huilen als we het even niet meer zagen zitten, en vooral samen zingen. Alles kan bij jou en bij jou kan ik volledig mijzelf zijn. Ik vind het heel bijzonder om je nu te zien als moeder en ben trots op de persoon die je bent.

*Marieke*, mijn oud-huisgenootje en goede vriendin. Bedankt voor alle wandelingen die we afgelopen jaren hebben mogen maken samen, waarbij jij met je nuchtere blik mij altijd goede adviezen gaf. Niet alleen op professioneel vlak, maar ook over alle andere aspecten in het leven.

*Nina & Carina*, mijn PhD chicks waar mijn hele avontuur in Nijmegen mee begon. Tijdens die allereerste PhD borrel van werk klikte het gelijk met jullie. Het was altijd fijn om samen te sporten, te eten (vooral bij Tati) en films te kijken. Samen zwemmen, dansen en fietsen met kippen op Down the Rabbit Hole zijn mijn mooiste herinneringen met jullie samen. Jullie hebben mijn tijd in Nijmegen onvergetelijk gemaakt! Ik vind het een hele eer dat ik mijn PhD mag afsluiten met jullie aan mijn zijde als paranimfen.

*Danielle*, mijn schrijfmaatje en PhD vriendin. Heel wat woorden uit dit proefschrift heb ik geschreven met jou naast met jou naast mij in de biebof terwijl jij mij aankeek vanuit je beeldscherm via Zoom. Altijd fijn om met jou te praten over onderzoek en onderwijs. Ook bedankt voor de gezellige spelletjes- en kaas-avondjes.

Dank aan mijn schoonouders, *Petra & Tonnie*. Bedankt voor alle keren dat jullie op Saartje hebben gepast, voor het logeren in Nijmegen, het helpen met klussen in ons huis en de gezelligheid als ik bij jullie op bezoek ben.

Dankjewel *Linda, Thanh & Hugo*. *Linda*, als grote zus heb jij mij altijd laten zien wat doorzettingsvermogen inhoudt. Ik heb veel van je geleerd en jouw adviezen zijn altijd zeer behulpzaam geweest. *Thanh*, bedankt voor al jouw positieve energie, niet alleen tijdens mijn PhD. *Hugo*, je bent altijd welkom voor logeerpartijtjes bij ons thuis en ik ben ontzettend trots dat ik jouw tante 'Sisa' mag zijn.

En vooral bedankt aan mijn ouders, *Paul & Jeanette*. Jullie hebben mij altijd gesteund en mij geleerd om door te zetten. Dankjewel voor jullie eeuwige vertrouwen in mij, ook als ik het zelf even niet meer zag zitten. Daarnaast hebben jullie ook een specifieke rol gespeeld bij mijn proefschrift. *Paul*, onzettend handig dat jij behalve mijn vader, ook nog de PhD coördinator van Farmacie aan de Universiteit Utrecht was. Je had altijd goede adviezen over mijn artikelen en PhD project. Bedankt voor het doorlezen van mijn proefschrift en het checken op foutjes. *Jeanette*, ook jij als conector van het Christelijk Gymnasium Utrecht kon mij goed helpen bij mijn onderzoeken. Je was altijd bereid om mijn mails door te sturen naar docenten en leerlingen op jouw school zodat ik genoeg proefpersonen kon verzamelen.

En tot slot, lieve *Tina*, zonder jou was mijn proefschrift nooit afgekomen. Dankjewel dat je altijd alles voor mij relativeert als ik zelf gestrest ben. Dat je alle huishoudelijke klusjes deed, zodat ik ongestoord door kon werken. Dat je altijd naar mij luistert, adviezen geeft en mij soms terecht wijst. Door corona konden we sneller gaan samenwonen, omdat ik niet meer iedere dag in Nijmegen hoefde te zijn voor werk. Het was het helemaal waard om voor jou naar Nieuw-Vennep te verhuizen en ik had met niemand anders liever 24/7 willen doorbrengen tijdens de lockdown. Dankjewel dat je ervoor hebt gezorgd dat ik een echte dierenliefhebber werd. Ik ben heel blij dat Lotje, ons konijntje, en Saartje, ons hondje, nu deel uitmaken van ons gezin. Zij zorgen ervoor dat we regelmatig in de buitenlucht zijn en ons hoofd kunnen leeg maken. Ik ben ontzettend trots dat jij mijn vrouw bent en ik kijk uit naar de rest van ons leven samen.



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