Depressive Symptoms in Adolescence: Consequences, Mechanisms, & School-based Prevention Efforts

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ABSTRACT

A substantial number of adolescents experience pronounced emotional, social, and behavioral problems during the transition from childhood to adulthood. Depressive symptoms are among the most common mental health problems during adolescence (Costello, Erkanli, & Angold, 2006), and are associated with high relapse and recurrence rates (Lewinsohn, Clarke, Seeley, & Rohde, 1994) as well as a variety of comorbid disorders (Bettge et al., 2008). Depressive problems in adolescence are further associated with a number of adjustment difficulties (e.g., interpersonal problems, academic difficulties), affecting young individuals' lives in various environments. Whereas the association between the family environment and depressive symptoms in adolescence has received much attention in previous research, research interest in the role of the school environment has been less pronounced.

Although prior research has provided valuable knowledge about factors associated with depressive symptomatology in adolescence and has offered several effective depression prevention programs, a multitude of questions still remain unanswered. Combining theoretical and methodological approaches from clinical psychology, educational science, and developmental psychology, the present dissertation aimed to contribute new and important insights into depressive symptomatology in adolescence, acknowledging the importance of school as a developmental context. Specifically, the dissertation addresses (a) consequences of adolescent depression (and anxiety) in the school context, (b) factors that might influence the effectiveness of (school-based) depression prevention programs, and (c) mechanisms driving alterations in processing of social information in adolescents with depressive symptomatology.

Study 1 examined the academic (reading achievement, mathematics achievement) and social (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) development of adolescents with compared to without internalizing problems (i.e., symptoms of depression and anxiety). $N = 1,062$ students were assessed annually from fifth through eighth grade. The results suggest a significant disadvantage across all investigated functioning domains for students with internalizing problems at fifth grade. The results further showed that students with internalizing problems either fail to compensate for this disadvantage over time (in mathematics

achievement, peer-rated acceptance, and relationship with parents) or that the disadvantage gets even more pronounced (in reading achievement and teacher-rated acceptance). Only in self-rated acceptance did students with internalizing problems show more positive development compared to students with no such problems.

Study 2 investigated factors hypothesized to influence the effects of two indicated depression prevention programs—a school-based cognitive behavioral group-based program (CB group) and a cognitive-behavioral bibliotherapy program (CB bibliotherapy). Combining data from two trials, $N = 631$ at-risk adolescents were randomized into CB group, CB bibliotherapy, or an educational brochure control condition. Moderating effects of individual (initial depressive symptoms, motivation to reduce depression, negative cognitive style), demographic (sex, age), and environmental (social support, negative life events, substance abuse) factors on depressive symptom reductions and major depressive disorder (MDD) onset were investigated from pretest through 2-year follow-up. The results showed that both CB prevention programs are more beneficial for youth with at least moderate depressive symptoms, and that CB group is more effective for motivated individuals. The findings further implied that substance use reduces the effectiveness of CB group-based depression prevention.

Study 3 investigated alterations in facial affect processing related to adolescent depression, the association of these alterations with social experiences, and the underlying mechanisms driving these alterations (perceptual sensitivity vs. response bias). In an emotion recognition task, $N = 60$ adolescents with high or low depressive symptoms rated the predominant affective expression in ambiguous stimuli with varying intensity (happy-sad, happy-angry, sad-angry), prior to and following an experience encapsulating social exclusion, inclusion, or no social involvement with the depicted model identities. The results suggest no general difference in emotion recognition between those with high versus low depressive symptomatology, but for adolescents with high depressive symptoms, an increased perceptual sensitivity emerged for processing of facial affect in partners who had previously rejected them.

The findings of the three studies are summarized and discussed in light of the broader research context and the current state of the literature on adolescent depression. Implications for future efforts and directions in clinical and educational research and practice are considered.

CONTENT

1   INTRODUCTION

Adolescence is the time of transition from caregiver-dependent child to an autonomous adult. This is a period of substantial change and challenge in an individual's life, and for many the term "adolescence" is laden with a slightly negative connotation. Although almost every parent of an adolescent child might be able to tell a thing or two about unexplained mood swings, miscommunication, or rebelliousness, acknowledging the difficult and troubling nature of adolescence is not a new perception. In fact, the pronounced changes and challenges during adolescence have led to the notion that the time of adolescence might mark a starting point of maladaptive development.

At the beginning of the last century, G. Stanley Hall defined adolescence as an evolutionary-based and thus ubiquitous and inevitable time of emotional turmoil or "storm and stress" (Hall, 1904). Today, after over a century, Hall's "storm and stress" hypothesis is still a widely referred to and highly influential concept in research on adolescence, although most contemporary psychologists reject the view that storm and stress during adolescence is universal and inevitable (e.g., Eccles et al., 1993; Laursen, Coy, & Collins, 1998; Steinberg & Levine, 1997). In fact, a multitude of studies have shown that in reality the majority of adolescents go through this life stage unscathed (Offer & Schonert-Reichl, 1992; Steinberg, 2008)—an observation that has led to a reformulation of the storm and stress hypothesis; rejecting the notion of the universal and inevitable nature of change that undergoes adolescence (Arnett, 1999).

One might argue that both approaches to studying adolescence are vestigial perceptions of the time period as they emphasize the dichotomy of storm and stress—a pathologizing view of adolescence that does not offer a reasonable basis for scientific work (Hollenstein & Lougheed, 2013). Although many individuals experience an unproblematic transition from childhood to adulthood, it is known from previous research that a substantial number of adolescents experience marked emotional and social problems as they transition from childhood to adulthood (e.g., Graber, Lewinsohn, Seeley, & Brooks-Gunn, 1997; Kracke & Silbereisen, 1994; Mendle, Harden, Brooks-Gunn, & Graber, 2012). For such individuals, adolescence might in fact constitute a time of various maladaptive developmental processes and experiences. For instance, previous research has shown that about 20% of individuals experience at least one episode of

depression before reaching adulthood (Newman et al., 1996). Moreover, depression as well as subclinical depressive symptoms are highly impairing conditions associated with comorbidity of other psychiatric disorders as well as increased risk for suicide attempts, interpersonal problems, delinquency, unemployment, subsequent marital difficulties and substance abuse (Angold & Costello, 1993; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Gotlib, Lewinsohn, & Seeley, 1998; Newman et al., 1996; Reinherz, Giaconia, Hauf, Wasserman, & Silverman, 1999). Mood disorders are further associated with poorer academic performance, an increased risk to drop out of school, and a high rate of absenteeism (Masten et al., 2005; McLeod & Kaiser, 2004; Verboom, Sijtsema, Verhulst, Penninx, & Ormel, 2014). Another concern is that the disorder oftentimes takes a recurrent course (Birmaher et al., 1996) and can therefore substantially impact a young person's path through life. Accordingly, depressive symptoms in adolescence are not only relevant because these problems are debilitating to a child or teenager's everyday life but also because they impose risk for a persistent course with future psychopathology and maladaptive behavior in adulthood.

Considering these unsettling findings, it becomes obvious that depressive symptoms are associated with problems in various domains of life, affecting not only the afflicted individual but also those in their immediate environments: parents and siblings at home, as well as peers, teachers, and other school personnel within the school system. Whereas the association between individual, family characteristics, and depressive symptoms in adolescence have frequently been studied in the literature (Betts, Gullone, & Allen, 2009; Branje, Hale III, Frijns, & Meeus, 2010), the role of the school context has been less explored. During adolescence there is no place outside their homes where adolescents spend as much time as in school (Eccles & Roeser, 2009; Rutter, Maughan, Mortimore, Ouston, & Smith, 1979). Thus, school is not only an important developmental context because it is where adolescents learn and undergo intellectual maturation, but also due to the social aspect of the school setting (Bergmüller, 2007).

When considering the importance of school as a developmental context, several questions arise about how adolescents with depressive symptoms interact in a school environment. To further illustrate this point, let us take a hypothetical person: Eva, 14 years old, exhibits depressive symptoms both at home and in school. Eva's parents will be primarily confronted with Eva's troubles in the home environment. However, when reflecting about the consequences of Eva's problems in the school context they might ask

themselves: "What are the consequences of Eva's depressive symptoms *in* school? How do these symptoms impact her performance and her relationships with peers?" Conversely, within the school context, her teachers and other school personnel might have another pressing question: "Here in school, what can we do to deal with Eva's problems and how can we help her?" Based on current scientific literature, these questions can hardly be answered conclusively. Yet, in order to work toward a better overall understanding of depressive symptomatology in adolescence one might ask the following counter-question: "Which processes and mechanisms do we have to understand to answer these questions in a satisfactory manner?"

The aim of the present dissertation is to provide a meaningful contribution toward answering each of these questions. First, this dissertation aims to explore academic and social consequences of depressive symptomatology in adolescents. Second, the current work focuses on the examination of school-based prevention efforts and factors that might increase the benefit of such programs in adolescents already dealing with elevated levels of depressive symptomatology. Finally, mechanisms underlying the association between depressive symptoms and social functioning (i.e., facial affect processing) will be explored.

Thus, the present dissertation is structured into nine comprehensive chapters. Following this introduction, Chapters 2 through 4 provide a broader theoretical and contextual framework for the investigation of consequences, mechanisms, and school-based prevention efforts in adolescents with depressive symptomatology. In Chapter 2, depressive symptoms in adolescents will be discussed in a concise manner, touching on epidemiology, course, and comorbidity, as well as risk factors associated with depressive symptoms. A special emphasis will be on the theoretical and empirical basis of facial affect processing. In the last section of Chapter 2, the presented factors will be integrated in a theoretical model to describe the emergence and maintenance of depressive symptomatology in children and adolescents. Chapter 3 presents school as an important environmental context for adolescents in general, and more specifically adolescents with depressive symptoms. The current state of research on academic and social consequences of depressive symptoms in the school context will be discussed. In Chapter 4 the need for effective depression prevention programs in schools will be discussed and will then be followed up by an argument for the proliferation of research on moderators of depression prevention program effects. The last section of the chapter will provide a succinct

summary of the literature body on moderating factors of prevention program effects. Chapter 5 will introduce the research questions guiding the three empirical studies that will subsequently be presented in Chapters 6 through 8. The first study longitudinally assesses adolescents' internalizing problems and their impact on academic and social functioning after the transition from primary to secondary school. The second study explores putative moderators of the effects of a school-based and a bibliotherapy-based depression prevention program. The third study assesses alterations in facial affect processing, the underlying mechanisms of these alterations, and their association with social experience. In the final chapter of this dissertation, the findings of the studies presented in Chapters 6 through 8 will be summarized and integrated into a broader conceptual framework. To conclude the present dissertation, implications for future directions in research and clinical as well as educational practice will be discussed.

2   DEPRESSIVE SYMPTOMS IN ADOLESCENCE

In the developmental psychology literature, adolescence has been defined as the time period an individual experiences between the ages of 11 to 21 (Steinberg, 1993). Though there are some differences in allocation of specific ages, typically adolescence is divided into three broad phases: early adolescence (11 to 14 years), middle adolescence (15 to 17 years), and late adolescence (18 to 21 years). In this time period of transition from a caregiver-dependent child to an autonomous adult, an individual experiences change and growth on a multitude of levels.

Biologically, as individuals transition from child to adult, adolescents experience distinct physical and physiological maturation, especially during early adolescence (Brooks-Gunn, Graber, & Paikoff, 1994; Susman et al., 2010). Over time, the adolescent brain experiences ongoing changes in its structure (Caskey & Ruben, 2003; Kwon & Lawson, 2000). Individually, there is evidence that adolescents' identities become increasingly stable as they age (Meeus, Iedema, Helsen, & Vollebergh, 1999). With regard to their personality, adolescents change into the direction of maturation. As they grow older, adolescents become more methodical, deliberate, and decisive, but also more considerate and charitable (Roberts, Walton, & Viechtbauer, 2006). Cognitive abilities such as working-memory, decision-making, and risk-taking continue to develop (Inhelder & Piaget, 1958; Piaget, Cook, & Norton, 1952), and adolescents show improvements in reasoning as well as information processing and expertise (Steinberg, 2005). Authors investigating the social aspect of cognition have shown that the way adolescents think about others becomes more abstract, more differentiated, and more multidimensional over time (Eisenberg, Morris, McDaniel, & Spinrad, 2009).

Moreover, many other changes occur that pertain to the social aspect of life. During adolescence, peer relationships deepen as more time is spent with peers than with families; peer networks are expanded, and first romantic relationships are formed (La Greca & Prinstein, 1999; Masche, 2006). Further, close friends begin to replace parents as the primary source of social support for adolescents and significantly contribute to adolescents' self-concept and well-being (Furman & Buhrmester, 1992).

The rapid changes in biological, cognitive, and social domains during adolescence are associated with an increased risk for both a heightened potential of both positive and

negative outcomes. Even though research suggests that the majority of adolescents manage to deal with the personal changes they are confronted with during adolescence without suffering from major problems (Dryfoos, 1990; Offer & Boxer, 1991), there is a substantial number of adolescents who do experience marked emotional and social difficulties (e.g., Graber et al., 1997; Kracke & Silbereisen, 1994; Mendle et al., 2012).

Following a dichotomous classification system, behavioral problems in childhood and adolescence can be classified as *externalizing* or as *internalizing* behaviors (Cicchetti & Toth, 1991). Externalizing behaviors are characterized by under-controlled behavior and an outer-directed mode to responding. Examples for externalizing behaviors include aggression, oppositional or defiant behavior, as well as impulsivity and hyperactivity (Furlong, Morrison, & Jimerson, 2004). On the opposite side of the spectrum, internalizing behavior patterns represent an over-controlled and inner-directed response mode, characterized by behavior patterns such as depression or dysthymia, social withdrawal, anxiety and somatization problems. As opposed to the dysregulated behavior of the more outwardly visible externalizing problems, such internalizing problems like anxiety or depression, are oftentimes less obvious to the immediate environment and thus tend to be overlooked (Walker & Severson, 1992). This is concerning for various reasons. First, depression and depressive symptoms are very common in the general population of children and adolescents, and less than half of those affected by depression receive treatment (e.g., Kessler, Avenevoli, & Merikangas, 2001). Second, early-onset mental health disorders show particularly unfavorable outcomes with regard to severity and chronicity as compared to later-onset mood disorders (Giaconia et al., 1994; Hoehn-Saric, Hazlett, & McLeod, 1993; Kovacs, 1996). Third, depression, as well as depressive symptoms are associated with an increased occurrence of comorbid disorders (Angold, Costello, & Erkanli, 1999; Avenevoli, Stolar, Li, Dierker, & Merikangas, 2001). And finally, depression is associated with high relapse and recurrence rates, suggesting it to be a recurring condition that can impact an individual over a long period of time (Lewinsohn et al., 1994).

2.1 Conceptualization and Symptomatology

Prior to the last quarter of the 20th century, adolescent depression received comparably little attention in empirical research. Indeed, many researchers widely held

the misconception that depression and depressive symptoms do not exist in children and adolescents (Glaser, Strauss, & Strutzel, 1968; Toolan, 1962). It was not until the 1970s, when research interest in mood disorders in pediatric populations started to increase. Based on findings, researchers concluded that depressive disorders clearly occur during childhood and adolescence, can be debilitating on a clinical level, and are associated with various maladaptive outcomes, including future psychopathology (Albert & Beck, 1975; Carlson & Cantwell, 1979; Cytryn & McKnew Jr, 1972; Kashani & Simonds, 1979; Rutter, 1986).

To be categorized as having a Major Depressive Disorder (MDD), the current Diagnostic and Statistical Manual of Mental Disorders. 5th ed. (DSM-V; American Psychiatric Association, 2013) requires an individual—irrespective of whether it is an adult or an adolescent— to experience persistent change in mood, manifested by either depressed or irritable mood (that occurs throughout most of the day and nearly every day), and/or a loss of interest and pleasure in all or almost all activities. Additionally, at least four of the seven specified symptoms need to be reported (i.e., changes in weight or appetite, insomnia or hypersomnia, psychomotor changes (agitation or retardation), fatigue or loss of energy, feelings of worthlessness or guilt, decreased concentration or indecisiveness, and thoughts of death/suicide; American Psychiatric Association, 2013).

This current system, as frequently exercised in both practice and research on adolescent depression, assumes discontinuity between clinical and subthreshold depression (i.e., a more modest number of depressive symptoms), where most but not all of the criteria for DSM-V MDD may be met. However, previous research has shown (e.g., Lewinsohn, Solomon, Seeley, & Zeiss, 2000) that with regard to their impairment levels, adolescents with high depressive symptom levels are almost indistinguishable from those who have been diagnosed with a full threshold depressive disorder, suggesting the current line between having or not having a diagnosis to be arbitrary. Youth who fall short to fulfill the current criteria of MDD might be wrongfully neglected.

This kind of research falls into the controversy about whether psychiatric conditions comprise discrete categories or are best viewed as a quantitative variation of "normal" affective experience (e.g., Solomon, Haaga, & Arnow, 2001). The ongoing debate about whether the psychopathology of depression is a matter of category or dimension is of considerable importance not only with regard to the development and advancement of diagnostic systems like the DSM-V (American Psychiatric Association,

2013) but also when dealing with adolescents who suffer from "subthreshold" or "subsyndromal" adolescent depression (Cuijpers, Smit, & Van Straten, 2007; Fergusson, Horwood, Ridder, & Beautrais, 2005).

In recent years there has been considerable interest in the investigation of such depressive symptom patterns that fail to fulfill all criteria for a clinical depressive disorder diagnosis. Assessing an adult sample, Judd, Akiskal, and Paulus (1997) investigated the association between functioning impairment and depressive symptoms/MDD and found that individuals with depressive symptoms did not differ from those with a diagnosis for all but one of the investigated functioning domains. Specifically, participants with depressive symptoms showed elevations on multiple markers of adverse functioning, such as healthcare utilization. In their summary of the growing literature on the effects of depressive symptoms in children and adolescents, Gillham, Shatté, and Freres (2000) report increased risk of drug and alcohol use, academic failure, dropout, and teen pregnancy for those affected. In another study, Gotlib, Lewinsohn, and Seeley (1995) investigated differences between adolescents with elevated levels of depressive symptoms who did not meet diagnostic criteria per a clinical interview (labeled "false positive") and diagnosed (labeled "true-positive") participants. The authors found that false-positive and true-positive participants did not differ on most measures of psychosocial dysfunction and showed no differences in risk for future depression. They concluded that contrary to implicit assumptions, suffering from symptoms but not from a full threshold disorder is not a benign condition, but rather warrants intervention efforts in its own right. Indeed, by targeting adolescents with elevated symptoms of depression, escalation to full syndrome may be prevented (e.g., Clarke et al., 1995; Clarke et al., 2001; Stice, Shaw, Bohon, Marti, & Rohde, 2009).

Evidently, both categorical and dimensional conceptualizations of adolescent depression has certain advantages and a clear-cut distinction between the two representations is not necessarily possible. Specifically, whereas dimensional representations provide information about a larger variety of adolescent problem behaviors, categorical representations offer a pragmatic cutoff to be used for diagnosis. Cutoffs can be thought of as defining clinically significant groups and providing the opportunity to generalize across studies. In studies using samples from the general population of adolescents, cutoffs of questionnaire measures provide an economical and

rapidly deployable method to assess depressive scores and determine subgroups according to their symptom level.

2.2   Epidemiology, Course, and Comorbidity

It is well documented from a multitude of epidemiological studies that depression is among the most common emotional problems during adolescence. In a heavily cited meta-analysis, Costello, Erkanli, and Angold (2006) found overall prevalence rate estimates to be 2.8% for under 13-year olds, and 5.6% for adolescents between 13 through 18, with higher rates for girls (5.9%) than boys (4.6%). These findings underline the rise in incidence of depression from childhood to adolescence and the greater occurrence rate of depression in girls than in boys (e.g., Duggal, Carlson, Sroufe, & Egeland, 2001; Hankin et al., 1998). In a large representative study with German adolescents, 21.9% exhibited signs of mental health problems and 5.4% showed depression (Ravens-Sieberer, Wille, Bettge, & Erhart, 2007). Prevalence rates of depressive symptoms are even higher with findings indicating that up to 20 - 50 % of adolescents exceed conventionally established adult cut-offs for clinically significant depression in symptom recall periods between one week and six months (Kessler et al., 2001). A newer epidemiological study using self-report data from 12,395 adolescents found 29.2% to be depressed on a subthreshold level (Balazs et al., 2013).

In addition to the high percentage of adolescents suffering from depression, the impairing nature of these problems also becomes evident when considering the high relapse and recurrence rates. In an investigation of time course parameters of depression in a community sample of adolescents between 14 and 18, Lewinsohn, Clarke, Seeley, and Rohde (1994) found that of adolescents who had experienced and recovered from an episode of depression 5% relapsed within a half year, 12% relapsed within one year, and approximately 33% within the next four years. Another early study on depression recurrence in childhood and adolescence showed that 26% of treated individuals relapsed within a year and 40% within two years (Kovacs et al., 1984). Further, Steiger, Fend, and Allemand (2015) showed that the impact of depressive symptoms in adolescence can reach far into adulthood. In their study, depressive symptoms were prospectively related to adult self-esteem and depressive symptoms three decades later. It is important to note that even though reported relapse and recurrence rates are generally high, the exact

numbers vary considerably between studies (Birmaher, Brent, & Issues, 2007; Kessler et al., 2005), most likely due to the different methodological approaches used.

Depression and depressive symptoms in adolescents are highly comorbid with other symptoms of distress during this time and these findings have been shown to be more frequent and stronger than in an adult sample (Pataki & Carlson, 1995; Rohde, Lewinsohn, & Seeley, 1991). Comorbid disorders of depression range from externalizing disorders and behavioral problems (e.g., Bettge et al., 2008; Ihle & Esser, 2002; Kovacs, Paulauskas, Gatsonis, & Richards, 1988) to eating disorders (e.g., Santos, Richards, & Bleckley, 2007), personality disorders (Kasen et al., 2001), and substance use disorders (Fleming & Offord, 1990). Anxiety disorders are the most common comorbidity among youth with depression, with comorbidity estimates ranging from 15% to 75% (Angold et al., 1999; Avenevoli et al., 2001; Yorbik, Birmaher, Axelson, Williamson, & Ryan, 2004). Results from the German BELLA-study (Bettge et al., 2008) show high rates of self-reported comorbid problem prevalence rates in the age group of 11 to 17 year-olds (girls: anxiety 44.6%, hyperactivity 16.6%, suicidality 20.2%, problematic eating behavior 47.9%; boys: anxiety 33.9%, hyperactivity 11.5%, suicidality 13.8%, problematic eating behavior 26.5%).

In summary, not only is depression a highly prevalent mental health problem in adolescence, it is also associated with marked relapse and recurrence rates as well as high comorbidity with a variety of other mental health issues. In the following section, the focus will be on a review of the empirical literature on risk factors that might contribute to the emergence and maintenance of depressive symptomatology.

2.3   Risk Factors and Correlates of Depression

A large amount of research has focused on the investigation of risk factors associated with the emergence and maintenance of depression and depressive symptoms. As defined by the World Health Organization (2012), a risk factor is "any attribute, characteristic, or exposure of an individual that increases the likelihood of developing a disease or injury". Not only is research on risk factors essential because knowledge about variables that make adolescents vulnerable to depression is important in its own right; a reliable prediction of psychopathology can serve to inform intervention and prevention efforts in both, research and practice. According to Offord and Kraemer (Offord &

Kraemer, 2000) two defining characteristics of risk factors can be specified: the risk factor serves to differentiate between those of high or low risk of a certain psychopathology within a population, and the risk factor precedes the development of psychopathology. If this temporal order cannot be clearly proven, oftentimes due to the cross-sectional or uni-directional research design employed in different studies, then we refer to such a variable as a correlate. Previous research has identified risk factors as well as correlates from various domains, including biological, social, and cognitive ones. The following summary of these findings represents a concise summary and is by far not exhaustive. In a separate section, alterations in facial affect processing will be discussed and emphasized as an important contributing factor to etiology and maintenance of depressive symptomatology.

Biological factors. The significance of genetic factors in the etiology and maintenance of depression and depressive symptomatology has been subject of investigation in a multitude of family, twin, and adoption studies. Children with a parent that suffers from depression have up to a six-fold risk of developing a depressive disorder themselves (Lewinsohn & Essau, 2002). Moreover, children of depressed parents are at increased risk to experience other psychopathological disorders including anxiety disorder, conduct disorder, or substance abuse (e.g., Hammen, Burge, Burney, & Adrian, 1990; Weissman, Fendrich, Warner, & Wickramaratne, 1992; Weissman et al., 1987). Relatively high heritability estimates of 40 to 65% have emerged in twin studies (cf. Graber, 2004) although results differ depending on age, sex, and informant. There is an assumption that a genetic predisposition in offspring of depressed parents is responsible for the cross-generational transmission of depression (Kendler, Gardner, Neale, & Prescott, 2001), environmental and psychosocial factors (e.g., maladaptive parenting), cannot be neglected as important and potentially causal mechanisms driving this relationship (e.g., Goodman & Gotlib, 1999). Accordingly, interest in specific gene variants that interact with environmental factors has grown substantially in recent years. For instance, Caspi and colleagues (2003) found that children who were severely mistreated had a doubled risk of depression if they had two copies of the short allele promoter polymorphism of the gene encoding the serotonin transporter (5-HTT). In contrast, those maltreated during childhood with two copies of the long allele polymorphism did not have an increased risk of depression. Aligned with this finding, a review of 34 human observational studies indicated that the length polymorphism in the

serotonin transporter gene (5-HTTLPR) moderates the effect of life adversity in the development of depression (Uher & McGuffin, 2010). Results from another meta-analysis support this finding (Karg, Burmeister, Shedden, & Sen, 2011). It is important to acknowledge the fact that one meta-analysis failed to provide support for the existence of an interaction between the 5-HTTLPR and life stresses. However, this meta-analysis has been rightfully criticized on many grounds (Karg et al., 2011; Uher & McGuffin, 2010). Taken together, the findings on gene-environment interaction are promising.

Although a large amount of studies on physiological concomitants of depression have been conducted, there is only little evidence to date for the existence of specific physiological markers for depression. This might in part be due to necessary methodological and design requirements that were not met (cf. Brooks-Gunn, Auth, Petersen, & Compas, 2001). However, several physiological determinants of depression require consideration. For instance, previous research has indicated that alterations of noradrenergic, serotonergic, and dopaminergic neurotransmitter systems are pathologically involved in the etiology of depression (for a review, see Saveanu & Nemeroff, 2012). However, no single system seems to be solely responsible for the emergence of depression—a circumstance not surprising when one considers the variety of depressive symptomatology (Saveanu & Nemeroff, 2012). Another relatively consistent and robust finding of biological risks for depression is a disruption in the physiological stress response. Much of the previous work on the physiological response to stressors has focused on the hypothalamic–pituitary–adrenal (HPA) axis, which, alongside the sympathetic-adrenal-medullary (SAM) axis, is one of the major biological stress response systems in humans (Thapar, Collishaw, Pine, & Thapar, 2012). The HPA axis functions through the coordinated activity of secretion of corticotrophin releasing hormone (CRH) and arginine–vasopressin (AVP) from the hypothalamus, which in turn triggers the release of adrenocorticotrophin hormones (ACTH) from the pituitary. ACTH then enters the blood circulation and is transported to the adrenal cortex, where it stimulates the secretion of glucocorticoids (i.e., cortisol). The release of cortisol serves as an initiator of various physiological changes that provide appropriate, adaptive, and beneficial responses to acute or discrete stressors. In depressed or at-risk adolescents, the HPA system has been linked to altered responses to stress by virtue of higher cortisol secretion and reactivity—a result that mimics HPA axis dysregulation in adult depression (Goodyer, Tamplin, Herbert, & Altham, 2000; Guerry & Hastings, 2011; Rao, 2006).

Female gender has emerged as another substantial biological risk factor for depressive symptomatology and depressive disorder. Whereas research suggests no significant differences between genders in prepubertal children, or even a slightly higher prevalence of depression among boys (Nolen-Hoeksema & Girgus, 1994; Saraceno, Heron, Munafò, Craddock, & van den Bree, 2012), there are higher prevalence rates for girls from midpuberty onward (Costello et al., 2006). This gender difference is further consistent with findings from epidemiological studies in adult populations that suggest a two- to threefold higher rate of depression in women compared to men (e.g., Lewinsohn, Hoberman, & Rosenbaum, 1988). Several researchers have provided theoretical models explaining why girls are more likely to be depressed than boys during this time (Cyranowski, Frank, Young, & Shear, 2000; Hankin & Abramson, 2001). Hankin and Abramson state in their model that distal, pre-existing vulnerabilities of genetic, psychological, and environmental nature influence the development of cognitive vulnerabilities specific to depression (for a review, see Hankin et al., 2009). To provide some examples, it has been suggested that the cultural pressure of fitting the thin-ideal (Thompson & Stice, 2001) and the alterations in body shape during puberty (Davison & McCabe, 2006; Woodside & Kennedy, 1995) are dreaded by girls more so than by boys. Other researchers argue that the occurrence of negative life events significantly impact girls in particular. Research suggests that girls experience more negative life events than boys (Thapar et al., 2012) and that they react more negatively to such stressors (Hankin & Abramson, 2001). This finding may also account for the development of gender differences in adolescent depression. Nolen-Hoeksema and Girgus (Nolen-Hoeksema & Girgus, 1994) emphasize that girls are less physically and verbally aggressive than boys, and have a more ruminative self-focused style.

Social and environmental factors. The relationship between environmental and social factors and depressive symptoms is of crucial importance because many symptoms of depression are manifested in the interpersonal domain, thus impacting adolescents in a variety of social contexts. In particular, the family serves as a central influential factor for the psychosocial development of adolescents and needs to be mentioned here (e.g., Jaffee, Caspi, Moffitt, Belsky, & Silva, 2001). Due to the nature of cross-sectional studies, speaking of risk factors might be premature in some cases. Nevertheless, several familial factors have emerged as correlates of depressive symptoms and depressive disorder. These factors include parental psychopathology and maltreatment (Jaffee et al., 2002), as

well as family dysfunction (Hill, Pickles, Rollinson, Davies, & Byatt, 2004). A prospective longitudinal study revealed that negative parental characteristics such as hostility and low levels of parental warmth predicted adolescents' depressive symptoms over time (Ge, Best, Conger, & Simons, 1996).

In the context of the family environment, socioeconomic status (SES) needs to be mentioned as a risk-factor for the occurrence of mental health problems (e.g., Gilman, Kawachi, Fitzmaurice, & Buka, 2002). Ravens-Sieberer and colleagues (2007) found that the prevalence of depression for children and adolescents from families with low socioeconomic status was 7.3% as compared to 3.8% for those from families with high socioeconomic status.

One of the most consistently found risk factors that can be subsumed under environmental and social risk factors for onset of depression and increase in symptoms is the occurrence of stressful life events (Lewinsohn et al., 1994; Nolen-Hoeksema, Girgus, & Seligman, 1992; Windle, 1992). Stressful life events are thought to increase in the second decade of life due to the significant biological and social transitions during this time period (Ge, Conger, & Elder Jr, 2001). This notion is underlined by the observation in previous research that the average young adolescent encounters more stressful life events than the average preadolescent (Larson & Ham, 1993).

Robust effects have emerged for social support as a factor to place adolescents at risk for depression. Theoretically, deficits in support from both family and peers may foster depression because adolescents perceive this lack in acceptance in their interpersonal environment, which consequently leads to decreases in self-esteem and confidence (Cohen & Wills, 1985). Results from a large amount of studies indicated that deficits in social support prospectively predicted future increases in depressive symptoms for adolescents (e.g., Galambos, Leadbeater, & Barker, 2004; Kaltiala-Heino, Rimpelä, Rantanen, & Laippala, 2001; Sheeber, Hops, Alpert, Davis, & Andrews, 1997; Slavin & Rainer, 1990), as well as future onset of depression (Lewinsohn et al., 1994; McFarlane, Bellissimo, & Norman, 1995).

Finally, developmental and clinical psychologists have long recognized the significance of peer relations for long-term positive adjustment (Brown & Bakken, 2011; Bukowski, Pizzamiglio, Newcomb, & Hoza, 1996; Newcomb, Bukowski, & Pattee, 1993). On the opposite site of the spectrum, the experience of poor peer relations, such as peer rejection, peer victimization, or low peer acceptance has been shown to precede

psychological difficulties in several studies (Panak & Garber, 1992; Patterson & Capaldi, 1990). Vernberg (1990) used self-reports and longitudinal analytic procedures, and found that rejection among adolescents in seventh and eighth grade predicted depressive symptoms at 6-month follow-up. Likewise, results from another study (Kiesner, 2002) suggest, that low initial peer status predicted depressive symptoms at a later time, even after controlling for prior depressive symptoms.

Cognitive factors. Cognitive theories of depression emphasize the central position of cognitive processes in the etiology of depression. In the second half of the last century, Aaron Beck developed the potentially most influential theory of depression development (Beck, 1967, 1987), in which he proposed that negative thoughts about oneself, the world, and the future (i.e., the negative triad), negative schemata, and cognitive biases constitute the central risk of developing depression. Another influential theory, the learned helplessness theory, was developed in 1976 by Maier and Seligman, and later reformulated by Abramson, Seligman, and Teasdale (1978). This reformulated theory of helplessness and depression was later revised into the hopelessness theory of depression (Abramson, Metalsky, & Alloy, 1989).

Negative attributional style is central to a number of the above-mentioned cognitive models of depression. For instance, in the hopelessness theory of depression (Abramson et al., 1989) it is proposed that negative attributions play a key role in depression onset. According to this model, individuals at risk for depression make internal, stable, and global attributions for negative events. In the presence of life stressors, such attributions serve as a vulnerability and thus increase the likelihood of an individual to develop depression (Abramson et al., 1989).

Other cognitive factors such as rumination (e.g., Abela, Brozina, & Haigh, 2002; Rood, Roelofs, Bögels, Nolen-Hoeksema, & Schouten, 2009; Schwartz & Koenig, 1996) and negative schemata (e.g., Essau, Groen, Conradt, Turbanisch, & Petermann, 1999) have been implied as potential factors influencing incidence and severity of depression. It is worth mentioning that functional cognitions can also serve as protective factors by buffering against distress following a stressful life event (e.g., Lightsey, 1994; Taylor & Brown, 1994). This theory is supported by a study in a sample of fifth and sixth graders (Hilsman & Garber, 1995). The authors found that in the presence of an academic stressor, having positive cognitions protected against negative affect. The importance of targeting cognitions in prevention and therapy cannot be overemphasized, when considering the

findings in the literature on cognitive precedents of depressive symptoms and the buffering effect of positive cognitions.

2.4   Focus: Facial Affect Processing

Clearly, the maladaptive processes described in cognitive theories of depression—and underscored by previous literature—are likely to play an important role in the social life and functioning of adolescents. However, neither original cognitive nor interpersonal theories of depression provide specific assumptions of the underlying mechanisms that establish this association. Thus, on a distal etiological level, depressed adolescents' behavior in social situations might be strongly influenced by more proximal etiological factors, such as cognitive processes and mechanisms.

Social information processing theory has offered detailed models (e.g., Crick & Dodge, 1994; Dodge, 1986; Lemerise & Arsenio, 2000) to intertwine social as well as cognitive aspects of adolescent behavior. For one, social information processing theories have advanced our understanding of how adolescents' encoding and interpretation of social situations may influence their reaction or behavior. Moreover, these models have also greatly contributed to furthering our understanding about subsequent adjustment difficulties that may arise for adolescents after experiencing negative social interactions. In the following, two influential models of social information processing will be presented as a theoretical framework for the subsequent summary of the literature on facial affect processing in individuals with depressive symptoms.

Reformulating one of the most influential models of social information processing (Dodge, 1986), Crick and Dodge (1994) incorporated the step of goal selection, and included social schemata and knowledge—aspects that had previously been ignored. According to Crick and Dodge's model, adolescents approach social situations with social schemata and social knowledge. In a social situation adolescents receive a set of social cues (e.g. being excluded by a group of peers), and in turn their behavioral reaction is a function of how they process this social information. The model proposes that processing of social information occurs through the following six steps: (1) encoding of external and internal cues, (2) interpretation of those cues, (3) selection of goals, (4) response access, (5) response decision, and (6) behavioral enactment.

While encoding (step 1) and interpreting (step 2) the social cues in a given social situation, the adolescent is guided by relevant social knowledge that has its foundation in previous social experiences, thus influencing the social attributions that the adolescent makes. For instance, an adolescent who frequently experiences rejection by others might attribute the reasons for a specific situation, such as being excluded by peers, to the peers' willful intention to ignore the adolescent rather than accidental circumstances (e.g., peers are too caught up in their game to notice the adolescent). In step 3, the adolescent generates possible goals for the social situation. The goal that is given highest priority during this step is likely going to be the one driving later behavioral strategies. During step 4, the adolescent will access their long-term memory to search for possible responses to the social situation. Here, the likelihood of the chosen response will naturally depend on the social strategy repertoire available to the adolescent. Step 5 of the social information process is characterized by the evaluation of possible reactions and then a decision on a specific behavioral response. The final step involves enacting the response choice made during step 5. It is important to note that the six steps proposed in this model are not linear but rather incorporate feedback loops. Figure 1 provides an example of an adolescent's social information processing in a social situation with peers.
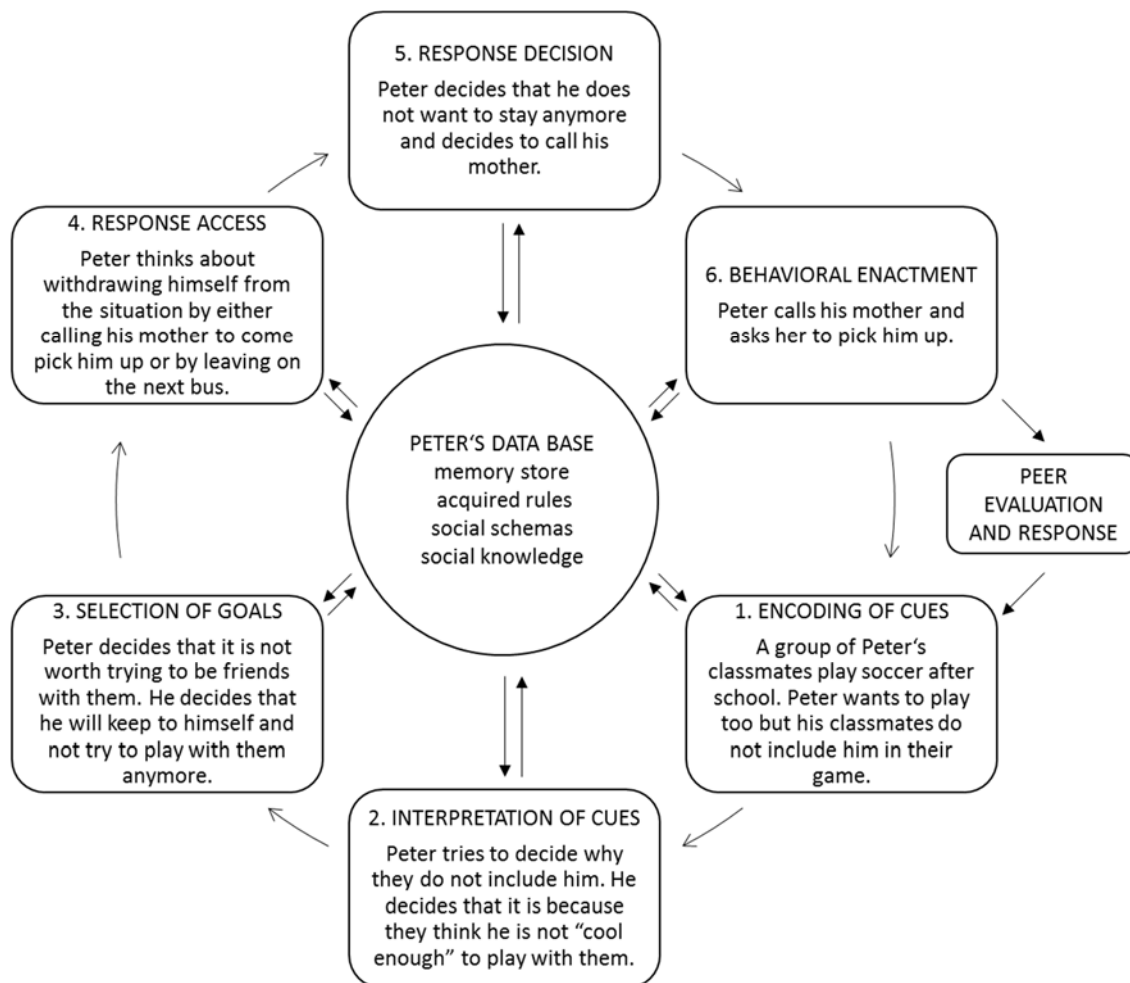
Figure 1. Example of the social information processing steps an adolescents takes when deciding how to respond in a social situation with peers (adapted from Crick & Dodge, 1994, p. 76).

Another important model of social information processing was proposed by Lemerise and Arsenio (2000). In their modification of the earlier model by Crick and Dodge (1994) the authors incorporate emotional processes, emphasizing that emotion plays a critical role in each step of the model. When confronted with a specific situation, adolescents will face this situation with a specific emotional style (i.e., the way in which they express and experience emotions), and a certain mood. In a social interaction, the partner's affective cues (e.g., a smile) also poses an important source of information that needs to be encoded and interpreted. The other steps of the social information processing model may also be impacted by the emotional experience of the interaction partners. For instance, aroused negative emotion in reaction to an interaction partner displaying an

angry facial expression might lead to the selection of a hostile goal and ultimately an aggressive behavioral response.

From both models it can be concluded that the detection, interpretation, and response to an interaction partner's facial affect expression are of essential importance to positive human contact. This notion is underlined by the finding that the ability to recognize and process facial emotion expressions has been universally observed across many cultures, including isolated tribes (Ekman et al., 1987). As about 60% of communication is nonverbal (Burgoon & Bacue, 2003), it is hardly surprising that the processing of humans' facial emotion expressions is one of the most extensively studied areas of social functioning. Social interactions largely rely on the emotions conveyed in one's face, (a) because facial expressions communicate one's affective state, and (b) have an influence on subsequent generation and regulation of emotional states, and behavior in response to social cues. Accordingly, distortions somewhere in this process may represent one of the key factors related to the etiology and maintenance of affective symptoms, problems in social interaction, and behavioral tendencies such as withdrawal or feelings of rejection (Bourke, Douglas, & Porter, 2010; Suslow & Dannlowski, 2005).

Research findings on facial affect processing. A main focus of previous research on facial affect processing has been the investigation of full-blown facial affect expressions in adults, a field of research that has yielded inconclusive results. To provide an example from research on depressed adults, findings on accuracy comparisons of facial affect expressions suggest that depressed individuals experience difficulties in the accurate identification of happy (Joormann & Gotlib, 2006; Mandal & Palchoudhury, 1985), sad (Rubinow & Post, 1992), or both facial expressions (Mikhailova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996). Other studies found no differences compared to healthy controls (Bourke et al., 2010; Aiste Jusyte & Schönenberg, 2014).

A potential explanation for such inconsistency in findings can be drawn from theories of (social) cognition (Beck, 1967; Crick & Dodge, 1994) that propose that alterations in emotion processing should be most prominent for ambiguous information. Accordingly, the heterogeneity of results in depressed adults may be explained by a deficit in the processing of ambiguous facial expression, rather than a processing deficit of prototypical unambiguous ones. In very recent years, research interest in the investigation of ambiguous facial affect processing has increased. Moreover, this research

interest has also extended to investigations of ambiguous facial affect processing in adolescent samples.

A recent study in which participants had to rate displayed faces of different emotional intensity (e.g., 90% sad and 10% neutral) found that depressed adolescents often perceived low-intensity emotional faces of any emotion as sad (Schepman, Taylor, Collishaw, & Fombonne, 2012). In another study, adolescent participants completed a forced-choice emotion identification task that consisted of various facial expressions morphed into stimuli with different intensities between an emotional expression (i.e., angry, happy, sad) and a neutral expression (Jenness, Hankin, Young, & Gibb, 2015). The results indicated that currently depressed adolescents more often misclassified happy and sad facial expressions as angry (Jenness et al., 2015). Studies that investigated facial emotion processing in adolescents at risk for depression produced contrary results, with one study indicating that these adolescents required greater intensity to accurately identify sad facial expressions than control participants (Joormann, Gilbert, & Gotlib, 2010) and another indicating that less intensity was required (Lopez-Duran, Kuhlman, George, & Kovacs, 2013).

Whereas morphed stimuli between neutral and emotional facial expressions were used in the aforementioned studies, other studies used stimulus material containing ambiguous facial expressions. The utilization of ambiguous facial expressions that contain conflicting information (e.g., a mix between an angry and a happy expression) allows for a more appropriate investigation of interpretative biases, which should be apparent in the predominantly negative judgments of these stimuli (Aiste Jusyte & Schonenberg, 2013). The results from studies in depressed or dysphoric adult samples suggest a bias toward a negative interpretation (Bouhuys, Geerts, & Gordijn, 1999; Liu, Huang, Wang, Gong, & Chan, 2012; Schönenberg et al., 2014; Schönenberg & Jusyte, 2014). To date, only one study has investigated truly ambiguous emotion discrimination in children and adolescents at high risk for depression (Lopez-Duran et al., 2013). In addition to morphed stimuli of an emotion and a neutral facial expression, Lopez-Duran and colleagues also used morphs between the emotions of sadness and anger. The results of the experiment showed that high-risk as well as control group participants exhibited an over-identification of sadness in ambiguous faces but this tendency was lower for participants in the high-risk group. Figure 2 depicts an example of a truly ambiguous stimulus set of a model identity.
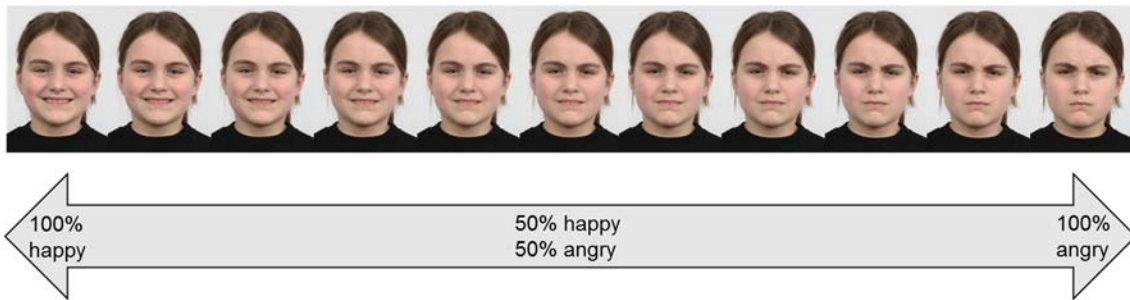
Figure 2. A stimulus set of one model identity parametrically varied in 10% increments ranging from 100% happy to 100% angry.

Mechanisms underlying alterations in facial affect processing. It remains unclear what mechanisms may underlie biased facial affect processing in adolescents with depressive symptoms. In order to gain further insight into the exact processes driving depression-related alterations, further knowledge about underlying mechanisms is of great importance. Previous research has discussed psychopathology-related shifts in perceptual sensitivity as well as an interpretation bias as possible causes for the observed alterations (Wilkowski & Robinson, 2012). Methods developed by signal detection theory allow for the investigation and separation of perceptual sensitivity and interpretation bias (Macmillan & Creelman, 2005). To exemplify this, let us take a classical recognition task with four possible outcomes. First, the individual successfully identifies a present stimulus (i.e., a hit). Second, the individual does not identify a present stimulus (i.e., a miss). Third, the individual correctly indicates that no stimulus was present (i.e., a correct rejection), and finally, the individual falsely indicated the presence of a stimulus even though it was not there (i.e., a false alarm). A bias, as described by the signal detection index of *beta*, is reflected by an increase in both hits and false alarms, indicating an overall tendency of the individual to indicate a stimulus as present regardless of whether it is in fact there or not (Macmillan & Creelman, 2005). By contrast, perceptual sensitivity, as described by the signal detection index of *d-prime*, occurs through an increase of hits but not false alarms. This pattern indicates that an individual correctly recognizes subtle increases in stimuli or intensity changes.

In summary, this section provided an overview over two theories of social information processing and their importance as a theoretical framework for the investigation of facial affect processing. Following the introduction of the two models,

the section summarized the literature on facial affect processing in adolescent depression, and finally showed the lack of studies using truly ambiguous stimuli in adolescent samples with depression. The summary of the literature body indicated that studies on the issue are scarce, especially in juvenile populations, and are widely dependent on methodological and design characteristics, such as the stimulus material, study population, and paradigmatic approach used. Considering the large knowledge gap with regard to underlying mechanisms of depression-related alterations in facial affect processing, perceptual sensitivity and interpretation bias were introduced as potential mechanisms driving such alterations.

2.5   Theoretical Integration

Reflecting on the variety of the above mentioned etiological factors of depression in adolescents, assuming a single theory that can account for the full range of emotional and cognitive processes and behaviors seems rather incongruous. In fact, an appropriate etiological model should account for the manifold of biological, social, and cognitive factors—thus suggesting a multifactorial approach. However, the integration of these various factors into an integrative theoretical framework is far from trivial, considering the fact that many of the above-mentioned factors also apply to other disorders such as anxiety. For several of the described factors, it is unclear whether they serve as risk factors or are simply correlates of depressive symptomatology. Nonetheless, it appears that a distinction between predisposing factors (e.g., genetic predispositions) and triggering factors (e.g., stress, negative life events) is necessary. Moreover, adolescence defined as a time period in which individuals have to deal with an increased number of developmental tasks (e.g., physiological and psychological maturation, growing independent from parents), might be a phase of increased vulnerability. In the following, the etiological–transactional model by Cicchetti and Toth (1998) will be presented as an integrative model of depression.

The etiological–transactional model explains depression development in adolescents by integrating components across biological and psychological systems. In this context, the authors consider the concepts of equifinality and multifinality. Equifinality describes the process by which a specific disorder develops via different developmental pathways, and multifinality describes the notion that certain

developmental events can lead to different adjustment outcomes across different individuals. Although this distinction deems necessary to describe development of psychopathology, typical distortions are observable in cognitive, socio-emotional, representational and biological functions, a concept that is described as *depressotypic organization* (Figure 3). Within an individual, the factors constituting the depressotypic organization are present to varying degrees and the way in which the factors interact differ inter-individually.
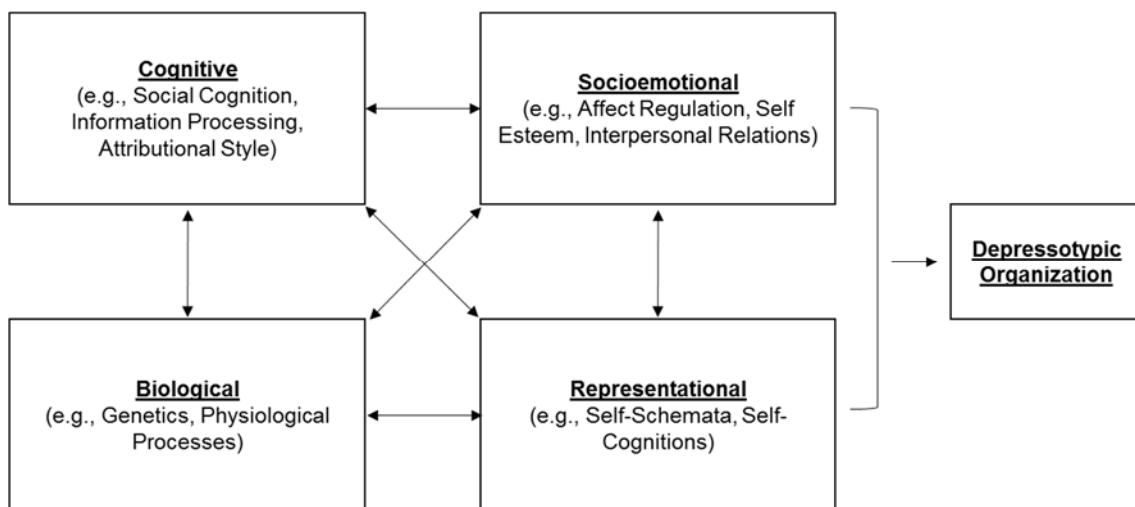
Figure 3. Integration of biological, cognitive, socioemotional, and representational systems in the emergence of a depressotypic organization (adapted from Cicchetti & Toth, 1998, p. 225).

In the etiological–transactional model, the depressotypic organization is embedded into an interplay between different levels and processes (Figure 4). Specifically, in reference to Bronfenbrenner's ecological theory (Bronfenbrenner, 1979), Cicchetti and Toth (1998) differentiate between a number of co-occurring environmental levels. Influences at distal levels (i.e. macrosystem, exosystem) and more proximal levels (i.e., microsystsem, ontogenetic development) impact the depressotypic organization and make the emergence of a depressive disorder more or less evident. Moreover, processes from each environmental level along with characteristics of the individual and the presence or absence of potentiating and compensatory processes mutually influence each other over time, thus shaping the course of child development. Depending on this interplay, the likelihood or a depressotypic organization and depressive symptomatology increases or decreases.
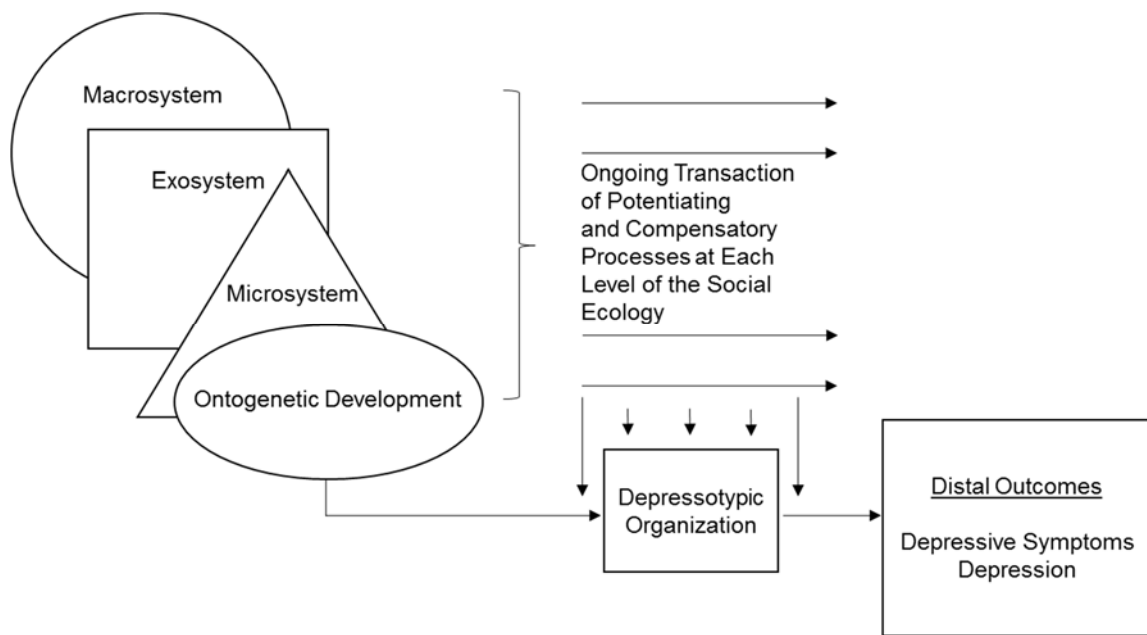
Figure 4. Transaction of multilevel potentiating and compensatory processes in the development of depressotypic organization and depressive outcomes (adapted from Cicchetti & Toth, 1998, p. 226).

Cicchetti and Toth's model (1998) has a number of important benefits as compared to other etiological models of depression. For one, the model provides a theoretical framework that can also account for the fact that there is a gender difference in depression starting in adolescence, with girls being at a higher risk to develop such symptomatology. Moreover, in contrast to other models, the authors use the concept of unspecific potentiation and compensatory processes at different levels of an individual's social ecology. Accordingly, the model is not limited to an explanation of the development of depressive symptomatology but can also serve to describe the etiology of broader dimensions of psychological problems, such as internalizing disorders (Bilz, 2008). Cicchetti and Toth's model also incorporates dysfunctional (social) information processing into the emergence of the depressotypic organization. Finally, by describing the different ecological levels, the model integrates all relevant developmental environments – from the macrosystem (e.g., societal influences) to the microsystem (e.g., familial influences). For the level of the exosystem, the authors put a special emphasis on

an adolescent's school environment – a developmental environment of great importance to adolescents that will be more closely discussed in the following chapter.

2.6   Interim Summary

Taken together, the information presented in this chapter suggests that for a long time, internalizing disorders such as depression were wrongfully neglected in psychological research. In fact, depression and depressive symptoms in adolescence are highly prevalent problems, and are characterized by marked stability over time as observed by high relapse and recurrence rates. The findings that depressive symptomatology oftentimes occurs first in adolescence and that prevalence of depressive symptoms increases significantly during the second decade of life, suggests that risk factors manifest early (e.g., predispositions) and some of them even become more pronounced during this time of vulnerability (e.g., impact of negative peer relations). Adequate facial affect processing was discussed as a vital component of successful social functioning. A model was presented to describe the etiology of depressive symptomatology in a developmental framework.

Certainly, knowledge about etiological factors that contribute to the emergence of depression or depressive symptoms is vital. However, several other questions arise. What are the consequences of depressive symptomatology? Do these consequences significantly impair functioning of the affected individual? If so, how does this affect depressed adolescents' social and academic life? And—leading back to the importance of the exosystem in Cicchetti and Toth's (1998) model—how do these problems play out in school?

3   CONSEQUENCES OF DEPRESSIVE SYMPTOMS IN SCHOOL

Alongside the family environment, the school setting is one of the major socialization contexts of children and adolescents (Eccles & Roeser, 2009; Rutter et al., 1979). Literally thousands of research articles, mainly from developmental and clinical psychologists, have focused on the impact of family factors on mental health issues in adolescents. On the other hand, school is an important developmental environment for adolescents with depressive symptoms but has been less explored in psychological research. Conversely, researchers with an educational science background acknowledge and emphasize school as an important developmental environment but naturally, the main interest of this discipline lies in the investigation of academic outcomes and associated factors. Accordingly, only very few studies put an additional focus on the investigation of inter-individual differences due to mental health problems such as depressive symptomatology. Nonetheless, adolescents with depressive symptomatology are faced with marked constraints on current but also future functional and developmental trajectories. These constraints can be seen as a serious threat to not only adolescents' well-being but also their academic and professional success.

In the first section of this chapter, the school environment as an important developmental context for youth with depressive symptoms will be discussed. Moreover, the section will touch on the potential influence of psychosocial school characteristics (e.g., the school climate), and the importance of school transitions. In subsequence, empirical findings on the consequences of depressive symptoms with regard to social and academic functioning will be presented and discussed in reference to the school context.

3.1   School as an Important Developmental Environment

Considering the large body of research on the impact of family function and dysfunction on adolescent health, questions arise about the way other environmental contexts can shape adolescent development. More precisely, do school-related factors impact functioning in adolescents with depressive symptoms? And if so, in which ways does this occur? Several researchers have applied themselves to investigate the association between factors related to the school environment and mental health.

Typically, factors of the school environment are divided into two broad categories: structural characteristics (e.g., type of school, size of school, size of classes, teacher qualifications) and psychosocial characteristics. Research on structural characteristics suggests only very weak effects on adolescent health and development (Dür, Fürth, & Griebler, 2006). Although studies have provided some support for an association between mental health problems and psychosocial characteristics, such as the perceived school climate (e.g., Buddeberg-Fischer, Klaghofer, Leuthold, & Buddeberg, 2000; Gazelle, 2006; Kuperminc, Leadbeater, & Blatt, 2001; Loukas & Robinson, 2004), the findings are very limited. This might, for one, be due to a lack in conceptual clarity. Specifically, to date there is no universally applied definition of what actually comprises this "climate". Thus, studies differ significantly in the concepts investigated. Further, usually the subjective perspective of those involved is emphasized (Van Houtte, 2005). Accordingly, results more likely represent depressed adolescents' idiosyncratic perceptions of climate. However, the understanding of school environments that promote adolescents' individual functioning requires a multilevel framework for thinking simultaneously about individuals' development within schools and classrooms. Thus to study the impact of the school environment on depressed adolescents' functioning, there is a need for alternative approaches to conceptualization and construction of measurement and analytical models consistent with multilevel systems. Clearly further research efforts are required to answer the questions of whether and how the school environment can impact depressed adolescents' functioning. Nevertheless, the school, alongside the home environment is an environment of fundamental importance to adolescents' development.

From the time young children first enter primary school until they complete formal schooling as adolescents or young adults, they spend more time in school than in any other place or institution outside their homes (Eccles & Roeser, 2009; Rutter et al., 1979). School is not only relevant because of the dissemination of curricular skills and knowledge but also because it is an important learning environment with regard to individual and social factors (Bergmüller, 2007). These observations dovetail with findings from a recent report by the Organisation for Economic Co-operation and Development (OECD). Presenting longitudinally assessed data from nine OECD countries, the report entitled "Skills for Social Progress: The Power of Social and Emotional Skills" (OECD, 2015) emphasizes the importance of schools for fostering children's social and emotional skills.

However, not all adolescents are able to deal with the challenges they are confronted with in school in a positive and well-adjusted way. A seminal theoretical concept often utilized as a framework for studies exploring the association between school and adjustment difficulties in the developmental psychology literature is the stage–environment fit model by Eccles and Midgley (1989). The approach taken in this model allows for an integration of an adolescent's individual psychological development (stage) and the experience in an important developmental context such as the school (environment), as well as the dynamic of changing developmental needs as individuals move through the school system. The authors argue that optimal development occurs when the needs of a developing individual and the opportunities provided by their social environments, such as school, constitute a good stage–environment fit.

Accordingly, bad stage–environment fit is a frequently used explanation to describe the decrease in interest, motivation, and academic performance observable in early adolescence (for a review, see Eccles & Roeser, 2009). This series of negative findings in research studies—some of them dating back to as far as the early 1980s—lead to the proposition that these negative developmental changes are partially a result of the transition from primary to secondary school that occurs in early adolescence (Eccles & Midgley, 1989). More specifically, following the stage–environment fit line of reasoning, traditional secondary schools fail to provide developmentally appropriate educational environments for young individuals going through the critical time of early adolescence.

It is important to consider the possibility that adolescents with mental health problems are at a specific disadvantage to accomplish smooth school transitions compared to their healthy peers. Several research findings emphasize this course of argument. With regard to the primary – secondary school transition of students, prior research suggests that students with specific characteristics or problems might experience more pronounced difficulties than other students (West, Sweeting, & Young, 2010). For instance, Gray (1972) found that it is particularly children who exhibit behavioral inhibition (i.e. withdrawn or avoidant behavior, negative emotional states, and negative verbal and non-verbal expression), that experience adjustment difficulties at the beginning of secondary school. Similarly, results from another study suggests that anxious adolescents who had suffered from bullying in primary schools as well as students with lower self-esteem experienced poorer school transitions in general or with regard to their peer social system (West et al., 2010).

The above-mentioned findings dovetail with a growing body of research on the association between depression and adjustment difficulties. Whereas the majority of research on depression and functioning has focused on the perspective that poor functioning leads to depression, it needs to be considered that functioning problems in important life domains and contexts (e.g., in school) are in fact caused by depression. With respect to school as an important developmental environment for academic and social growth, poor functioning caused by depression can lead to significant negative consequences and in turn affect an individual's personal and professional life.

3.2   Academic Consequences of Depression

Learning and transfer of knowledge is the central function of school. However, depression is associated with a number of maladaptive cognitive (e.g., increased rumination, reduced working memory capacity), biological (e.g., loss of energy, sleep disturbances) and motivational (e.g., negative approach-based goal pursuit and striving for rewards) processes that are likely to negatively impact school outcomes such as learning and achievement (for a review, see Weidman, Augustine, Murayama, & Elliot, 2015). Considering the high prevalence rates of students suffering from depressive symptomatology it is highly surprising that to date, there is only scarce evidence in terms of the academic consequences that come from experiencing depression. Fortunately, a few new studies on the issue were conducted in very recent years, suggesting that interest in the issue is growing.

These newer studies have mainly investigated the relationship between depressive symptomatology and grade point average (GPA). Weidman and colleagues (2015) assessed students annually from Grades 6 through 8 and found that high depression as well as high anxiety at the beginning of a school year predicted lower GPA during the respective school year. Moreover, low GPA predicted higher depression and anxiety scores in the subsequent school year. Similarly, assessing high school students, Hishinuma, Chang, McArdle, and Hamagami (2012) found a predictive link from depression to self-reported GPA, but not the other way around. Verboom, Sijtsema, Verhulst, Penninx, and Ormel (2014) followed a sample of students from late childhood to late adolescence. Using teachers' ratings of their students' achievement, they found

that depressive symptoms and academic performances were bidirectionally related but only for girls.

However, research suggests that depressive symptoms not only predict GPA but also other outcomes related to academic success. For instance, results from a longitudinal study suggest that a set of depressive symptoms (i.e., subjective feelings of victimization, self-worth, and loneliness) predicted decreases in not only GPA but also school absenteeism in middle school students (Juvonen, Nishina, & Graham, 2000). Similarly, the results of a recent study examining the implications of adolescent depression in the process of school dropout showed that self-reported depressive symptoms in seventh grade increased the risk of school dropout in later adolescence (Quiroga, Janosz, Bisset, & Morin, 2013). In a comprehensive study, Fergusson and Woodward (2002) found that 21-year old adolescents from New Zealand, who had been depressed between the ages of 14 and 16 were more likely to have failed out of school, less likely to enter higher education, and more likely to be unemployed. Finally, although Rushton, Forcier, and Schectman (2002) examined many aspects of academic functioning in their representative sample, the only variable that showed to be associated with persistent depressive symptoms was school suspension.

3.3   Social Consequences of Depression

At first glance, teaching and learning might be the most obvious area of responsibility for schools, thus leading to an increasing interest in the relationship between depressive symptomatology and achievement in recent years. Nevertheless, especially because of the heightened importance of peer relations in adolescence and the permanent exposure to peers in school, the social consequences of depression in the school context should not be neglected. This notion is underlined by an early study in which the authors found that children with remitted depressive symptoms returned to having normal achievement skills but continued to show deficits in social skills (Puig-Antich et al., 1985). School is also an important developmental environment to discuss social consequences of depression (e.g. problems with peers) since friendship networks in adolescence are typically organized around school-based peer groups (Livingstone, 2008).

Most of the earlier work on the relationship between depressive symptoms and social skills (with a specific focus on peer relations) was guided on the premise that difficulties in peer relations precede psychological problems (e.g., Kiesner, 2002; Vernberg, 1990). On the other hand, studies following the premise that poor peer relations are a consequence rather than an antecedent of depression, are quite underrepresented. Summarizing previous research, Kochel, Ladd, and Rudolph (2012) provide several theoretical explanations for the way in which depression might lead to difficulties in peer relations. First, adolescents with depression may exhibit socially deficient behavior that potentially elicits responses of disliking or aggression in their peers. Second, depressed adolescents might enter maladaptive relationships, thereby increasing their risk for interpersonal conflict. And finally, withdrawn, passive, or fearful behavior exhibited by depressed youth might make them more prone to victimization.

Results from several studies lend support for the proposition that depressive symptoms are harbingers of poor peer relations. In the above mentioned recent study by Kochel, Ladd, and Rudolph (2012), in which the authors investigated the bi-directional relationship between depression and peer relations in a sample of fourth to sixth graders, the findings showed support for an influential effect of depressive symptoms on later peer difficulties. There was no support for an effect in the converse reaction, nor for a transaction between depression and peer problems. This finding is in line with the findings from another study in which belonging to a depressive subgroup was a predecessor for lower self-perceived social acceptance (Brendgen, Vitaro, Turgeon, & Poulin, 2002). Investigating Chinese middle schoolers and controlling for initial social preference, Chen and Li (2000) found that depressive symptoms negatively predicted social preference two years later. Aligned with the assumption that depressive problems precede functioning difficulties, Rohde, Lewinsohn, and Seeley (1994) investigated whether adolescents were changed by the experience of their first episode of major depression. The most prominent problems that emerged from an experience of depression was internalizing behavior, including social withdrawal.

Several researchers have investigated the predictive effect of depression on social support by making a distinction between perceived support from family and perceived support from peers. Whereas one workgroup found initial depressive and MDD symptoms to predict future decreases in peer but not parental support (Stice, Ragan, & Randall, 2004), another group of authors found that depressive symptomatology predicted

decreases in perceptions of family but not peer support (only in girls; Slavin & Rainer, 1990).

Research on the academic and social consequences of depressive symptoms is still an open field for several reasons, including the fact that the impact of depression on functioning difficulties has rarely been tested empirically using sufficient designs and methodology. The majority of studies examined the relationship between the constructs either cross-sectionally or uni-directionally, thus failing to provide information on the temporal association between depression and functioning difficulties. Further, sample characteristics differed immensely from study to study, for instance with regard to age. This is a highly important issue because developmental challenges adolescents face might be different depending on the developmental period they are in (early, middle, or late adolescence). All these issues, along with the general scarceness of data, can serve to explain the heterogeneity of data and thus hamper generalizability.

In sum, several conclusions can be drawn from this chapter. First, the impact of the school environment on mental health requires further exploration. It is important to consider the significance of the school environment as a key developmental context for adolescents, especially those with mental health problems such as depression. Second, the importance of the school environment is reflected in the recently growing interest in the academic and social consequences of depression in school. Third, the existing studies indicate that depression has a serious impact on adolescents' academic and social functioning, an issue that is especially confronted in the school context. And finally, more rigorous investigations of the impact of depression on functioning in school are needed in the future.

4   SCHOOL-BASED PREVENTION EFFORTS

Adolescents spend a very large proportion of their time at school, and it is considered to be among the most vital and influential developmental environments during this period of life (Eccles & Roeser, 2009; Roeser, Eccles, & Sameroff, 2000). Schools are in a position to target factors that are associated with the emergence and maintenance of depressive symptoms. Moreover, schools can provide access to mental health services to students who otherwise might not receive such services (Ginsburg & Drake, 2002). The school setting also allows for an immediate application of the skills conveyed in prevention programs (Barrett & Pahl, 2006). Finally, results from a meta-analysis (Durlak & Wells, 1997) suggest that school-based prevention efforts (with a mean effect size of .35) are more promising compared to prevention efforts in the family setting (with a mean effect size of .15).

Many teachers and other school personnel have a strong interest in programs that can target mental health issues, due to several reasons. First, the literature review presented in Chapter 2 suggests that adolescence has been shown to be a critical time of life with rising prevalence rates of depressive symptoms beginning in the early stages of adolescence and sustaining stable rates into adulthood. Accordingly, schools have to deal with an increasing number of students with depressive problems. Second, we have seen that less than half of those affected by depression receive treatment (Kessler et al., 2001) a fact putatively attributable to being overlooked due to stigma, or relative lack of systematic ascertainment of depressive symptomatology in primary care physicians (Cassano & Fava, 2002). Third, and perhaps most importantly to teachers and other school personnel, the findings reviewed in Chapter 3 suggest that those adolescents afflicted by depressive symptoms go on to face negative consequences in both academic (e.g., lower GPA scores, more absenteeism) and social functioning (e.g., less acceptance by peers, less social support). Considering all these aspects, it becomes evident that interventions at an early time point in at-risk adolescents' development might hold the potential to prevent escalation of symptoms and associated negative consequences. Accordingly, schools should invest time and resources into the promotion and facilitation of programs designed to address depressive symptoms in adolescence. Thus by employing prevention programs, they not only invest in the well-being of adolescents but

also serve to decrease the significant public health burden that arises from early-onset depressive symptoms and depression.

Generally, mental disorder prevention as defined by Mrazek and Haggerty (1994) aims at "reducing incidence, prevalence, recurrence of mental disorders, the time spend with symptoms, or the risk condition for a mental illness, preventing or delaying recurrences and also decreasing the impact of illness in the affected person, their families, and society".

In 1957, the Commission of Chronic Illness first introduced a public health classification system of disease prevention that was later adapted by Caplan (1964). The three types of prevention efforts described within this system entail *primary* prevention (i.e., decreasing the incidence of new cases of a disorder or illness in the population), *secondary* prevention (i.e., lowering the prevalence of a disorder in the population and aiming to eliminate risk factors for disorders early on), and *tertiary* prevention (i.e., preventing worsening of symptoms, or relapses or recurrences of a disorder). Although some researchers still use Caplan's classification system, the majority of prevention scientists use a newer approach by Gordon (1983), who established the terms of *universal*, *selective*, and *indicated* prevention. Mrazek and Haggerty (1994) explain these terms in the following way. Whereas *universal* prevention aims to reach an entire population (e.g., in anti-smoking campaigns), *selective* prevention focuses only on those who are at elevated risk for the development of a disorder. Finally, *indicated* prevention targets individuals that already exhibit some symptoms of a mental or behavioral disorder but do not meet criteria for a full diagnoses.

There are advantages for all three forms of prevention programs. Targeted (i.e., selective and indicated) prevention programs have the advantage of reaching those adolescents with the strongest need. Group-prevention efforts for such youth might be especially valuable because participants can connect with and relate to their peers who have similar problems (e.g., parental depression). Targeted prevention is also more cost- and resource-effective than universal prevention because only the subgroup of the population who is at highest risk for depression is addressed. A main advantage of universal prevention programs is the avoidance of stigmatization that might occur when individuals are singled out for participation in targeted prevention programs (Shochet et al., 2001). As all members in a population are addressed (e.g., the whole class instead of only a few at-risk students), universal prevention programs have a larger impact on

society because they influence the social context of participants, which might in turn have positive effects on troubled youth (Spence, 1998).

Different researchers prefer different approaches, which can explain the multitude of prevention programs of all kinds that are available today. However, it is important to note that the empirical record speaks a clear language with regard to the benefits of targeted versus universal prevention approaches. Meta-analytic reviews for depression prevention programs (Horowitz & Garber, 2006; Stice et al., 2009) but also prevention programs for other disorders (e.g., eating disorders; Stice & Shaw, 2004) suggest that selective and indicated programs produce significantly stronger effects than universal programs, although effect sizes are generally small to moderate in magnitude. Precisely, Horowitz and Garber (2006) reported a mean effect sizes of .30 for selective prevention programs and a mean effect size of .12 for universal prevention programs. The mean effect size for indicated prevention programs was .23. In the meta-analysis conducted by Stice's workgroup (2009), the mean effect size was .23 for studies involving high-risk participants. The mean effect size for universally implemented prevention programs was trivial with .04 and did not significantly differ from zero.

4.1   Relevance of Moderators for Prevention Research

An essential question that comes to mind when teachers, parents, and youth think of school-based prevention efforts may be "Would this prevention program work well for my student/my child/me *in particular*?" Whereas no one can answer this question for one particular individual, research may be able to provide a more general answer (Kraemer, Frank, & Kupfer, 2006). Specifically, if the individual has the same characteristics pertinent to beneficial program participation as compared to a control group that have been identified in previous research, he or she might in fact show better response than others. Such characteristics can be referred to as the moderators of treatment outcome. However, by moderators, we not only mean participant characteristics (e.g., gender, age, motivation to reduce symptoms) but also program characteristics (e.g., content features, program length, program setting) and provider characteristics (e.g., whether the program is facilitated by trained clinical researchers or by school personnel).

Accordingly, the effectiveness of depression prevention programs can vary considerably, depending on aspects that lie within the individual, but also aspects that

pertain to the program itself and the context in which a specific program is facilitated. This observation underlines the need to investigate putative moderating effects of depression prevention programs. The need for moderation analyses in prevention science is further highlighted by the fact that (a) moderators serve to specify for whom and under which conditions a prevention program works well, and (b) for whom and under which conditions a prevention programs does not work well. Moreover, neglecting potential moderating effects of depression prevention programs can lead to subsequent misinterpretation of findings (Tram & Cole, 2000). In addition, whereas the "First, do no harm" principle fortunately is a present and highly regarded standard of practice for most clinicians dealing with individual patients, researchers are often quick to proclaim the effectiveness of a particular program which can lead to a potentially harmful overgeneralization of program effects (Kraemer et al., 2006). Through moderation analyses, adolescents who are unlikely to benefit from a particular program or even experience iatrogenic effects can be identified. Accordingly, moderation analyses may not only provide information about youth who should be excluded from participation in a specific program because they do not benefit, but they also provide direction regarding the development of alternative programs for these youth. Finally, knowledge about moderators serves to maximize economical and cost-effective program dissemination.

4.2   Moderators of Depression Prevention Programs

In this section, a concise summary of previous findings on moderators of depression prevention programs will be presented. First, program characteristics, then provider characteristics, and finally, participant characteristics will be discussed.

As mentioned above, selective and indicated programs produce higher effect sizes than universal programs both at posttest and at follow-up (Horowitz & Garber, 2006; Stice et al., 2009). Being the first authors who investigated the moderating effects of program content, Stice and colleagues' meta-analysis revealed no impact of program content on magnitude of effects. Specifically, cognitive change, behavioral activation, problem solving, and social skills content did not moderate prevention effects. However the authors found that two other program features, which were intervention duration and homework did moderate effects. Precisely, shorter prevention programs produced significantly larger prevention program effects than did longer programs, an effect that

did not emerge in the previous meta-analysis by Horowitz and Garber (2006), potentially due to limited sensitivity. Also, programs with homework assignments produced significantly larger effects than programs that did not include homework assignments.

A novel contribution was made by Stice and colleagues (2009) who investigated a provider feature of previous depression prevention programs. Specifically, they tested the hypothesis that programs delivered by intervention professionals would produce significantly larger effect sizes than programs delivered by endogenous providers (e.g., teachers, school nurses). The findings did not find a significant difference between providers at posttest, but at follow-up, the data pattern fit the hypothesis.

With regard to participant features, sex and age are the most extensively tested putative moderators of depression prevention programs. Single trial studies of the moderating effect of sex generated mixed results, with some trials suggesting a stronger intervention effect for girls (e.g., Donker et al., 2013; Gillham, Hamilton, Freres, Patton, & Gallop, 2006), stronger effects in boys (e.g., Clarke, Hawkins, Murphy, & Sheeber, 1993; Seligman, Schulman, DeRubeis, & Hollon, 1999) or no moderation effect by gender (e.g., Gillham et al., 2012). However, summarized in meta-analyses (Horowitz & Garber, 2006; Stice et al., 2009), the effects of depression prevention programs have been shown to be stronger in females than in males. The results reported in these meta-analyses also suggest that prevention program effects are larger for older versus younger participants, an effect that has also emerged in single trial studies (e.g., Stasiak, Hatcher, Frampton, & Merry, 2014). Other participant features that have been investigated as putative moderators in previous research are minority status (Kindt, Kleinjan, Janssens, & Scholte, 2014; Stice et al., 2009), social support (Brière, Rohde, Shaw, & Stice, 2014; Gau, Stice, Rohde, & Seeley, 2012; Spence et al., 2014), cognitive style (Brière et al., 2014; Curry et al., 2006; Rohde, Stice, & Gau, 2012), substance use (Brière et al., 2014; Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Gau et al., 2012; Gilbert, Fine, & Haley, 1994; Rohde, Lewinsohn, Kahler, Seeley, & Brown, 2001), and major life events (Brière et al., 2014; Gau et al., 2012).

Altogether, although several factors have been shown to robustly moderate the effects of such programs (e.g., participant risk status with selective and indicated programs working better than universal ones), no clear conclusion can yet be drawn for other moderators. Nevertheless, insight from previous studies can help to inform and guide the design of future depression prevention trials in schools.

5   AIMS AND RESEARCH QUESTIONS

The overarching goal of this dissertation is to contribute to knowledge about consequences and mechanisms of depressive symptoms in adolescence, as well as school-based prevention efforts. As was shown throughout the theoretical introduction and literature review (see Chapters 2 and 3), depressive symptoms are highly prevalent and problematic during adolescence, pose a significant risk for relapse and recurrence, and are linked to maladaptive functioning in different life domains (see Chapters 2 and 3). However, the underlying mechanisms of difficulties in functioning—for instance with regard to maladaptive alterations in facial affect processing—have yet to be investigated. As presented in Chapter 4, school-based depression prevention programs may provide a suitable approach to deal with the high prevalence rates of depression starting in adolescence by intervening at an early time point in adolescent development.

Although prior research has provided valuable knowledge about factors associated with depressive symptomatology and has offered several effective depression prevention programs, a multitude of questions remain unanswered. Accordingly, the rationale for this dissertation pursues a clear-cut sequence of research questions. Subsequently, the specific research questions along with the aims and features of the three empirical studies within this dissertation will be elaborated:

I. How do internalizing problems (i.e., symptoms of depression and anxiety) influence students' academic and social functioning after the transition to secondary school and over time?

Theoretically based on the scar model (i.e., the proposition that depressive symptoms precede difficulties in functioning), Study 1 examined how students differ in their academic and social development and how internalizing symptoms contribute to these differences. Specifically, internalizing problem status directly after the transition to secondary school was analyzed to see how it influences developmental trajectories of academic (reading achievement and mathematics achievement) and social functioning (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) over time. Considering the importance of school as a developmental environment, surprisingly little research has investigated consequences of internalizing problems in the school context. Study 1 used data

from the Tradition and Innovation in School Systems Study (TRAIN; Jonkmann, Rose, & Trautwein, 2013) that followed 1,062 students from fifth through eighth grade, assessing their academic and social functioning once a year over that time period. Whereas previous research often lacked a multi-informant approach, this study had the respective teachers and classmates also provide information on students' social functioning outcomes, thus providing a richer view on the adolescents' behavior. The time period after the transition to secondary school was chosen as a particularly sensitive time for adolescent development with regard to educational careers and also emotional well-being.

II. Which factors positively or negatively influence the effects of (school-based versus bibliotherapy-based) depression prevention programs?

Study 2 assessed putative moderators of the effects of two cognitive behavioral depression prevention programs (one school-based group program, one bibliotherapy program). The significance of depressive disorders and the impact they have on both an individual's life and society emphasize the pressing need for effective depression prevention programs. Although different researchers have developed a large variety of depression prevention programs that can be implemented in schools, research on factors that can influence the success or failure of depression prevention programs is still young. Therefore this study combined data from two rigorous prevention trials and focused on the investigation of four individual, two environmental, and two demographic factors that might influence the effectiveness of such programs. Depressive symptom severity and major depressive disorder onset were examined as two critical prevention outcomes, using data available from pretest until 2-year follow-up. Whereas depressive symptom severity has been investigated in several moderation studies prior to this one, the major depressive disorder onset has only once been investigated previously. As the ultimate goal of depression prevention efforts is the prevention of depressive disorder onset, this study offers a vital extension of the literature. Hypotheses for each of the eight putative moderators were formulated based on theoretical considerations and, if available, results of previous research findings.

III. How do experimentally induced experiences of peer inclusion and exclusion impact social information processing in adolescents with depressive symptoms and what are the underlying mechanisms?

Considering the immense importance of correct recognition of nonverbal social signals for successful social interaction (see section 2.3), Study 3 sheds light on alterations in facial affect processing following social experiences (inclusion versus exclusion), as well as the association of these alterations with depressive symptoms in adolescents. Despite many research attempts to investigate facial affect processing and its relationship with depressive symptoms in adults, there is less research on the issue in adolescent samples, and the underlying mechanisms are barely understood. Furthermore, it is important to gain insights into the way potential alterations in the processing of facial expressions emerge in real-life interactions (e.g. experiences of social inclusion and exclusion). Thus, integrating emotional, cognitive, and social aspects, Study 3 is theoretically based on the integrated social information processing model by Lemerise and Arsenio (2000). To answer the research questions, a novel experimental and methodological approach was used in Study 3. In an emotion recognition task, adolescent participants with high versus low depressive symptoms rated the predominant affective expression (happy, angry, sad) in ambiguous peer stimuli with varying intensity. This was done prior to and following a negative (social exclusion), positive (social inclusion) or no social experience with the depicted peer model identities. To manipulate social experience, the so-called Cyberball-game was used. The Cyberball-game is a virtual ball-tossing game frequently used in experimental research to manipulate exclusion and inclusion in an ecologically valid manner. Aligned with previous research findings, we expected adolescents with high depressive symptoms to exhibit an enhanced processing for sad as well as a possible attenuation for happy expressions at baseline (before any social experience). In accordance with assumptions of cognitive reactivity, we expected that alterations in facial affect processing observed at baseline would be more pronounced following a social exclusion experience. Due to lack of previous research findings, no specific hypothesis was formulated with regard to the underlying mechanisms driving possible alterations.

6   STUDY 1

ADOLESCENTS' INTERNALIZING PROBLEMS AND THEIR IMPACT ON ACADEMIC AND SOCIAL DEVELOPMENT

Müller, S., Goellner, R., Lösch, T., Jusyte, A., & Trautwein, U. (2016). *Adolescents' Internalizing Problems and Their Impact on Academic and Social Development.* Manuscript submitted for publication.

Abstract

This study examined the academic (reading achievement, mathematics achievement) and social (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) development of adolescents with versus without internalizing problems (i.e., symptoms of depression and anxiety). The sample consisted of $N = 1,062$ students (*M age* = 10.76, *SD* = 0.68, 46.8% female) in Germany, assessed at 4 measurement points over a 3-year period from fifth through eighth grade. Students with internalizing problems were defined as the upper 15% scorers at the two first measurements. Growth curve analyses revealed significant differences between students with versus without internalizing problems at fifth grade and in change over time. At fifth grade, students with internalizing symptoms had significantly lower scores in all investigated functioning domains. Differences in change over time between students with versus without internalizing problems emerged for reading achievement (positive growth for both groups but less positive growth for students with internalizing problems), self-rated acceptance (positive growth for both groups but more positive growth for students with impairment), and teacher-rated acceptance (positive growth for those without internalizing problems and negative growth for those with internalizing problems). The findings underline the relevance of internalizing problems for students' academic and social functioning difficulties at fifth grade and over time, and the evidence makes a significant contribution to the scar model.

Keywords: adolescence, development, internalizing problems, functioning

Adolescents' Internalizing Problems and Their Impact on Academic and Social Development

Adolescence is a formative time in an individual's life, characterized by pronounced changes in various life domains. As they transition from childhood to adulthood, boys and girls experience striking changes in their cognitive capabilities, academic competencies, and social skills that equip them for the challenges of adult life (La Greca & Prinstein, 1999; Masche, 2006; Meeus, Iedema, Helsen, & Vollebergh, 1999; Robins & Trzesniewski, 2005; Steinberg, 2005). Though previous research has provided us with knowledge about normative development during adolescence, not all individuals develop in the same way and not all development occurs without problems. The reasons for developmental maladaptation in some adolescents are manifold and extend from a variety of individual (e.g., predispositions) to external circumstances (e.g., low social support from peers and teachers; Lerner, 1986, 1998).

Indeed, there are a substantial number of adolescents who do experience marked emotional and social problems. Specifically, with rates ranging in between 5 and 10%, internalizing problems (i.e., depression and anxiety) are highly prevalent and stable conditions (Graber & Sontag, 2009) that pose a significant risk for relapse and recurrence (Lewinsohn, Clarke, Seeley, & Rohde, 1994). Nevertheless, in contrast to the more outwardly visible externalizing problems, only few studies have investigated the way in which adolescents differ in their academic and social development and whether internalizing problems contribute to these differences. (e.g., Verboom, Sijtsema, Verhulst, Penninx, & Ormel, 2014; Weidmann, Augustine, Murayama, & Elliott, 2015).

In the present study, we examined the academic and social development of adolescents with versus without internalizing problems (i.e., symptoms of depression and anxiety) in a large sample of secondary school students. The purpose of the study was twofold. Specifically, we were interested in (a) differences at fifth grade in various academic and social functioning domains between adolescents with internalizing problems versus no internalizing problems, and (b) differences in trajectories for these functioning domains and subgroups over time, using a multi-informant approach to assess development over time.

Internalizing Problems in the Transitional Period from Childhood to Adulthood

Depression and anxiety symptoms are among the most common emotional problems in adolescence. In a large representative study with German adolescents, 10.0% suffered from anxiety, and 5.4% from depression (Ravens-Sieberer, Wille, Bettge & Erhart, 2007). In another

recent large study with 12,395 European adolescent participants, 32.0% of adolescents reported subthreshold anxiety and 29.2% subthreshold depression. 5.8% were classified as anxious, and 10.5% as depressed, with high comorbidity between the disorders (Balazs et al., 2013). Costello, Erkanli, and Angold (2006) conducted a meta-analysis and reported 2.8% for those under 13-years of age, and 5.6% for adolescents between 13 through 18, with higher rates for girls (5.9%) than boys (4.6%). Furthermore, depression and anxiety are disorders associated with high relapse and recurrence rates (e.g. Lewinsohn et al., 1994; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000), with early-onset disorders showing particularly unfavorable outcomes with regard to severity and chronicity as compared to later-onset anxiety and mood disorders (Giaconia, Reinherz, Silverman, Pakiz, Frost, & Cohen, 1994; Hoehn-Saric, Hazlett, & McLeod, 1993; Kovacs, 1996). Much previous research has been guided by the premise that adversities in academic and social development can serve as a potential explanation for this progressive pattern of relapse and recurrence (e.g., Kiesner, 2002; Lewinsohn, Gotlib, & Seeley, 1995; Vernberg, 1990). Conversely, internalizing problems might very well be at the root of functioning difficulties—an alternate premise that has received less attention in research so far.

The Association between Internalizing Problems and Youth's Academic and Social Functioning

Research from various disciplines relevant to health disparities has focused on the disadvantaged position of individuals with mental health problems (for reviews see Eaton, 1980; Göllner, 2014; Turner, Wheaton, & Lloyd, 1995). Socio-epidemiological studies on the subject reach back far into the last century. As early as 1939, Faris and Dunham pointed out that mental health problems can initiate social relegation. Further, results of a study that used a prospective longitudinal design suggest that mental disorders predict lower educational attainment (Miech, Caspi, Moffitt, Wright, & Silvia, 1999). Results like this indicate that mental health problems in adolescence might interfere with necessary educational qualification processes (e.g., high absenteeism due to illness) and also hinder successful social functioning (e.g., experiences of rejection or withdrawal). In the long run, this can negatively impact adolescents' academic and social functioning, placing them at a disadvantaged position in life.

Over the past decades, the scar model has emerged as a prominent theory describing this association. The scar model (Lewinsohn, Steinmetz, Larson, & Franklin, 1981) focuses attention on the hypothesis that internalizing problems antecede the development of impairments in academic and social functioning that remain after the depression has ended (Nolen-Hoeksema, Girgus, & Seligman, 1992; Rohde, Lewinsohn, & Seeley, 1990; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009). With regard to depression, several researchers have

described the driving mechanism behind the scar model to be that depression or depressive symptoms persistently deteriorate an individual's self-concept and increase vulnerabilities for continued impairments (e.g., Coyne & Whiffen, 1995; Lewinsohn et al., 1981). Despite its clear theoretical foundation, the scar model has rarely been tested empirically—an observation that is surprising. Even though a large number of empirical studies indicate that internalizing symptoms are associated with various deleterious outcomes that can affect adolescents in different functioning domains (e.g., Kessler et al., 2012), limited research exists regarding the specific impact of internalizing problems on future social and academic functioning. In addition, studies investigating the association between internalizing problems and different functioning domains have yielded mixed results (for a review on social functioning and internalizing problems see Kochel, Ladd, & Rudolph, 2012; for a review on academic function and internalizing problems see Weidman et al., 2015). This observation might potentially be due to the fact that they differed significantly with regard to sample, design, and statistical methods. Based on the theory of the scar model, we next review evidence from important previous studies on the impact of internalizing problems on subsequent functioning outcomes.

To date, there is scarce and inconclusive evidence as to whether emotional impairment may compromise academic achievement (for a review see Weidman et al., 2015), as would be predicted by the scar model. Fortunately, some more recent studies suggest an increased attention in the issue. Assessing internalizing problems in students annually from sixth through eighth grade, Weidman and colleagues (2015) found that high depression as well as high anxiety at the beginning of a school year predicted lower GPA during the respective school year (and low GPA also predicted higher depression and anxiety scores in the subsequent school year). Likewise, Hishinuma, Chang, McArdle, and Hamagami (2012) found depression to be predictive of self-reported GPA. However, other longitudinal studies showed that depressive symptoms and academic performance were bidirectionally related (only for girls; Verboom et al., 2014) or failed to show a predictive association of emotional impairment to academic performance (Jaycox et al., 2009; Moilanen, Shaw, & Maxwell, 2010).

More consistent findings for the scar model have been reported for the influence of internalizing problems on peer relations. Using a longitudinal research design, Brendgen, Vitaro, Turgeon, and Poulin (2002) found that depression predicted lower subsequent levels of self-perceived social acceptance in fourth through sixth graders. Kochel, Ladd, and Rudolph (2012), studying the same age group, reported that depressive symptoms contributed to peer difficulties. Similarly, in a study that investigated a sample of Chinese middle school students and controlled for initial social preference, the authors found that depressive symptoms

negatively predicted social preference two years later (Chen & Li, 2000). Though Vernberg (1990) found evidence for an effect in the reverse direction (rejection among adolescents predicted depressive symptoms at 6-month follow-up), he also reported that greater depressive affect increased the likelihood of poor social functioning.

Only a handful of studies have prospectively tested whether internalizing problems leave a "scar" that impacts adolescents' relationship with parents. Studies on the link between mental health problems and family support have shown that depressive symptoms negatively predicted perceived relationship quality with parents (Branje, Hale III, Frijns, & Meeus, 2010), and family support (but only for girls; Slavin & Rainer, 1990). Furthermore, parent–child connectedness predicted decreases in depressive symptoms in both males and females (Boutelle, Eisenberg, Gregory, & Neumark-Sztainer, 2009). Conversely, depressive symptoms failed to predict future decreases in family support over follow-up in an adolescent sample (Sheeber, Hops, Alpert, Davis, & Andrews, 1997).

Taken together, the described studies do not provide a clear pattern of results for the scar model. Research on the scar model is still an open field because of several challenges: First, the inconsistency in findings might be due to the fact that the scar model has rarely been tested empirically using the design and methods that can adequately detect the association between internalizing problems and functioning. Many studies were conducted cross-sectionally or uni-directionally and, although they provide important knowledge about co-occurrence, they fail to give insight into the directional nature of internalizing problems and functioning. Second, previous studies have differed significantly with regard to sample characteristics, such as disorder investigated, clinical status, or age. Whereas some researchers have focused on clinical diagnosis of depression or anxiety, others have investigated just one of the two, focused on sub-clinical levels, or even a specific symptom or symptom cluster (e.g. negative mood; Hüsler, Blakeney, & Werlen, 2005). Moreover, researchers have focused on different developmental periods that are not easily comparable due to the specific challenges characteristic for particular age groups. Third, the translation of the theoretical model into empirical research might have been inaccurate. Specifically, the vast majority of research in adolescents has examined whether symptoms – and not the clinical status – influence youth development in different functioning domains (e.g., Branje et al., 2010; Kochel et al., 2012). Accordingly, the influence of such a clinical "scar"—and thus the actual scar model—was not adequately tested in studies using nonclinical participants. Fourth, different researchers have used different instruments to assess emotional problems and determine clinical diagnoses or cutoff scores for high symptomatology. And finally, the majority of previous research has employed mono-method assessments which

can lead to a difficulty in clearly separating the investigated constructs, and further provides only a unilateral view of adolescent functioning. To conclude, some of the heterogeneity in the literature described above can be attributed to the previously mentioned methodological issues and sampling differences in prior research (Sowislo & Orth, 2013).

The Present Study

The purpose of the current study was the examination of the influence of internalizing problems on academic and social functioning domains in early- to mid-adolescence. Theoretically based on the scar model, we aimed to analyze how internalizing problems at fifth grade impact developmental pathways in different domains of functioning over the course of three years using manifest growth curve models for different subgroups (internalizing problems versus no internalizing problems). Specifically, we assessed how internalizing problem status at fifth grade would influence trajectories of academic (reading achievement and mathematics achievement) and social (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) factors from fifth through eighth grade. In Germany, where the current study was conducted, students transition from primary to secondary school at the end of fourth grade. The time after the transition to secondary school is regarded as a difficult time period in students' educational careers but also regarding their well-being (see Eccles & Midgley, 1989; Eccles et al., 1993, for reviews).

The methodological approach taken has several strengths that allow us to extend previous literature. First, we utilized a 4-wave longitudinal design that allowed for a direct comparison of the trajectory differences between students with versus those without internalizing problems. Second, the sample of the current study consisted of students from the general population. Previous studies have mostly assessed clinically derived cohorts (e.g., inpatients) with a full threshold disorder or adolescents in treatment, which—considering the low number of youth receiving treatment—calls the generalizability of these findings into question (Sheeber, Davis, Leve, Hops, & Tildesley, 2007). Unfortunately, only few studies have assessed a student sample of the general population who were not pre-selected based on their internalizing symptoms. Finally, we were able to collect data from multiple informants (i.e., student self-reports, peers, teachers), thus providing a richer view on the adolescents' behavior. Precisely, data on internalizing problems was gathered from students, as was data for the academic outcomes, self-rated acceptance and relationship with parents. Classmates and teachers also provided information on students' acceptance (peer-rated acceptance and teacher-rated acceptance, respectively).

Method

Participants and Procedure

The current study used data from the Tradition and Innovation in School Systems Study (TRAIN; Jonkmann, Rose, & Trautwein, 2013). TRAIN is a longitudinal study, designed to analyze non-academic track students' development from grade 5, 6, 7, through 8 (in the following T1, T2, T3, and T4) after transitioning from primary into secondary education. The sample for this study consisted of 1,062 individuals (at T1: M age = 10.76, SD = 0.68, 46.8% female) from 47 classes enrolled in non-academic track schools in the German state of Saxony. Approximately 50% of all students in Saxony attend the non-academic track school type which primarily caters to students who will not proceed to university education but rather transfer into vocational training after tenth grade. 5.3% of the students in the current sample had an immigrant background (defined as at least one parent born outside of Germany). Academic track students were not enrolled in the study.

The study was conducted over two consecutive school days in classrooms and during regular session times in the first four months of the 2008/2009 (T1), the 2009/2010 (T2), the 2010/2011 (T3), and the 2011/2012 (T4) school years. Participation was voluntary and written informed consent was obtained from students' legal guardians prior to data collection. Trained research assistants administered the questionnaires and the standardized achievement tests. All participants were informed about the study objective and assured that the data collected would be used for scientific purposes only. The study was approved by the local institutional review boards and by the data protection officers in the respective ministries in the participating federal states of Germany.

Measures

Internalizing problems. In order to identify students with versus without internalizing problems, we used 13 items from the anxiety and depression subscale of the Youth Self Report (YSR) questionnaire (Achenbach, 1991) assessed at T1 and T2. The YSR and its subscales have been shown to be valid and reliable measures to assess problematic behavior in adolescents aged 11 to 18. Participants were provided with statements (e.g., "I feel lonely") and required to indicate the degree to which each statement applies to them on a three-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). Internal consistency for the subscale was α = .81 at T1 and α = .83 at T2. Based on internalizing problems scores, we computed cutoffs for internalizing problems versus no internalizing problems. We determined the cutoffs from the first two measurement time points in order to avoid problems with sensitivity. Students with

internalizing problems were defined as the 15% of students with the highest internalizing problems scores at either T1 or T2. This cutoff was chosen on the basis of prevalence rates of internalizing problems in the child and adolescent population (Balazs et al., 2013; Ravens-Sieberer et al., 2007). Students below this cutoff formed the group without internalizing problems. The internalizing problems group included a mean number of 256 students (range = 247 – 265) in the imputed datasets. Thus, around one fourth of students were in the internalizing problems group (23.3 – 25%) as they scored above the cutoff at T1 and/or T2, whereas the other 75 – 76.7% were in group without internalizing problems.

Reading and mathematics achievement. Standardized achievement tests were administered to assess students' reading comprehension and mathematics achievement with a set of academically valid test items. For reading comprehension, students were asked to read several texts and subsequently answer open-ended, closed-ended, and multiple choice questions in order to assess their ability to adequately retrieve and interpret the information provided in the text. For mathematics achievement, academically valid math test items with mostly closed response format were presented. Items for both reading and mathematics were administered via a complex multimatrix schema. Matrix sampling of items is a technique often used in educational research to minimize testing time per student. The complete set of items was divided into subsets whereby one of the item subsets was administered to each student. Common items in all subsets ensured the comparability of test scores at the level of individual students. This design allowed to compare achievement on the same metric over all four years and across all individuals (see Embretson & Reise, 2000, for more technical details). Item- and person-parameters for students' mathematics achievement were estimated with a 2-PL model using Mplus 7.2 (Muthén & Muthén, 1998–2012). The complete model was tested by estimating a four-dimensional Item Response Theory (IRT) model (one dimension for each measurement time point including measurement invariance across measurement occasions). A weighted likelihood estimation (WLE) method was used to estimate the individuals' ability. The reliabilities of the WLE scores were between .83 and .85 (math) and .79 and .82 (reading), indicating a good reliability of achievement scores.

Self-rated acceptance. The self-rated acceptance scale was derived from a German project on development in adolescence (Fend & Prester, 1986) and has been used in various national and international studies (e.g., Jonkmann, Trautwein, & Lüdtke, 2009). Four items were used to measure self-rated acceptance (example items: "I sometimes feel like a bit of an outsider in my class" and "My classmates don't pay attention to me in recess"). Items were rated on a 5-point Likert scale ranging from *strongly agree* to *strongly disagree*. The scale had

sufficient internal consistencies across time (α = .61 at T1, α = .70 at T2, α = .76 at T3, and α = .81 at T4).

Peer-rated acceptance. In order to assess acceptance by peers, sociometric peer ratings were conducted with study participants (Hughes, 1990). More specifically, students were asked to indicate their liking for each student in the classroom with the item "I like this student" on a 7-point scale (0 = *not true at all*; 7 = *very true*). The mean ratings a student received from classmates constituted the students' acceptance score (ICC(2) = .77 at T1, ICC(2) = .80 at T2, ICC(2) = .76 at T3, and ICC(2) = .75 at T4).

Teacher-rated acceptance. Teacher reported on student acceptance using three items, such as "This student has many friends among his/her classmates". Teachers rated each item from 1 (*strongly disagree*) to 5 (*strongly agree*). The scale has shown internal consistency throughout measurements with α = .92 at T1, α = .94 at T2, α = .92 at T3, and α = .93 at T4.

Relationship with parents. The relationship with parents subscale of the KINDL^R questionnaire (Ravens-Sieberer & Bullinger, 1998) was used to assess the quality of students' perceived relationship with their parents. The KINDL^R is a frequently used instrument to assess health-related quality of life in German speaking countries. The relationship with parents subscale consists of four Likert-scaled items (example item: "I got along well with my parents"). Each item addresses the students' experiences over the past week and is rated on a 5-point scale (1 = *strongly disagree*; 5 = *strongly agree*). Internal consistency of the scale was α = .73 at T1, α = .80 at T2, α = .81 at T3, and α = .84 at T4. Previous studies have shown that the KINDL^R is an appropriate measure of emotional well-being in childhood and adolescence and that it has satisfactory psychometric properties (Bullinger, Levke Brütt, Erhart, Ravens-Sieberer, & BELLA Study Group, 2008).

Covariates. Socioeconomic background and participant gender were used as covariates for the analysis. Socioeconomic background was assessed by using two of the most frequently used indicators of socioeconomic background in previous research: parent occupational status and immigrant background (Cirino et al., 2002; Murdock, 2000). Occupational status was assed using the *International Socio-Economic Index of Occupational Status* (ISEI; Ganzeboom, De Graaf, Treiman, & De Leeuw, 1992), a standard measure of an individual's occupational status with higher scores indicating higher status. Immigration background was assessed by asking both students and parents to indicate their native country. A student was defined as having an immigrant background if at least one parent was born outside Germany (0 = no immigrant background, 1 = immigrant background).

Statistical Analysis

To investigate how internalizing problems are related to academic and social functioning, we used growth curve models that provide a suitable analytic method to examine change over time. Further, growth curve analyses are a widely used analytical method in developmental research (Kashy, Donnellan, Burt, & McGue, 2008) because of their ability to model both the initial level at the first measurement point (i.e., intercept) and the rate of change over time (i.e. slope) for a specific construct (Stoolmiller, 1995; Windle, 1997) in an appropriate and parsimonious way (Bleidorn, 2012). Further, such models permit a more thorough exploitation of data than other analytical approaches like repeated measure analysis because they allow for the inclusion of study participants who did not provide information at all measurement points, a problem that often applies to large-scale longitudinal studies like the current one (Whitbourne, Sneed, & Sayer, 2009). Growth curve models additionally avoid difficulties associated with alternative modeling strategies like a cross-lagged analysis (e.g. Hamaker, Kuiper, & Grasman, 2015).

We computed our observed outcomes as a function of time (marked as a fixed interval, with T1, T2, T3 and T4) and represented by three types of variables: intercept, slope, and residuals. We specified a growth curve model for each dependent variable separately using Mplus 7.2 (Muthén & Muthén, 1998–2012). We specified six models: reading achievement, mathematics achievement, self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, and relationship with parents. Parents' occupational background, students' immigration background, and gender were included as time-invariant covariates, that is, both intercept and slope were predicted by those variables.

In order to investigate the differences between students with internalizing problems versus without internalizing problems, we used internalizing problems as predictor for both intercepts and slopes. Thereby, internalizing problem status was operationalized as a dummy-coded variable (0 = no internalizing problems, 1 = internalizing problems). Growth curves were modeled separately for each variable but simultaneously for both subgroups. A significant effect of impairment on the intercept would indicate differences between both groups at T1 (i.e., the fifth grade), whereas a significant negative effect on the slope would indicate different developmental trajectories across four years. We evaluated model fit using common fit indices, including the χ^2, the comparative fit index (CFI), the root mean square error approximation (RMSEA), and the standardized root mean square residual (SRMR). Specifically, for samples with $N \geq 250$, a nonsignificant χ^2 value, RMSEA < .06, SRMR < .07 and CFI > .95 all indicate a good fit (Yu, 2002).

To illustrate differences in fifth grade values and trajectories we calculated effect sizes for internalizing problems and additionally plotted the average development for all variables. We estimated effect sizes resembling Cohen's *d* (Cohen, 1992), based on the parameter estimates of the growth curve models. Cohen's *d* is defined as mean level differences between two groups divided by the pooled standard deviation. According to this, mean level difference between the impairment groups at the fifth grade was divided by the standard deviation of the intercept to determine the effect size of the internalizing problems at T1. The effect size of the internalizing problems on the trajectories was estimated in the same manner by dividing differences by the standard deviation of slopes. Plots of the trajectories were standardized based on the estimated slope deviation to allow for easy comparisons between the variables. That is, we first set the intercept of the non-impaired group equal to 0 as fifth grade comparison. To standardize the group difference (i.e., the regression coefficient of the latent intercept regressed on the impairment variable) and the latent slope, they were divided by the standard deviation of the latent slope. Based on these coefficients we generated plots representing average trajectories for the impaired and non-impaired group for all variables in a metric that is comparable to a z-standardization.

Missing data. Missing data on all examined variables occurred for 122 students (11.5%) at T1, 56 students (5.3%) at T2, 302 students (28.4%) at T3, and 376 students (35.4%) at T4. The drop in missing data at T2 was due to less missing data on the peer-rated acceptance variable. We ran multiple imputation to overcome the problem of missing data and reduced sample sizes. Specifically, we ran five imputations using an unrestricted imputation model (H1 imputation in MPlus; Muthén & Muthén, 1998–2012). We imputed missing data to include all individuals in our starting sample of 1,062 (i.e., the students who participated at the first measurement time point at Grade 5) and to obtain unbiased cutoffs indicating students with and without internalized problems. The imputation model included CBCL indicators for internalized problems (T1 and T2), reading achievement (T1-T4), math achievement (T1-T4), self-rated acceptance (T1-T4), peer-rated acceptance (T1-T4), teacher-rated acceptance (T1-T4), and relationship with parents (T1-T4). A total of 50 variables entered the imputation process. Based on the results of the imputation model, cutoffs were computed separately for each of the five datasets and subsequent longitudinal analysis were conducted on the imputed data. Results across multiply imputed datasets were combined according to Rubin's (1987) rules.

Results

Descriptive Statistics

Mean scores of internalizing problems in the sample were $M = 0.34$ ($SD = 0.43$) at T1, and $M = 0.38$ ($SD = 0.47$) at T2. Internalizing problems at T1 and T2 were correlated with $r = .51$. The correlation analysis of internalizing problems and all investigated outcomes over the 4 measurement points indicated no significant correlations between reading achievement and internalizing problems at T1, and low but significant negative correlations between reading achievement and internalizing problems at T2 (see Table 1 for correlation matrix). The same pattern emerged for the relationship between mathematics achievement and internalizing problems. Out of the investigated outcomes, internalizing problems correlated highest with self-rated acceptance (significant correlations of $r = .33$ to $-.66$). Low but significant negative correlations emerged for the association between internalizing problems and peer-rated acceptance ($r = -.1$ to $-.22$) as well as teacher-rated acceptance ($r = -.05$ to $-.21$). Correlations between internalizing problems and relationship with parents decreased over time (from $r = -.34$ to $-.17$ at T1, and $r = -.37$ to $-.24$ at T2). Reading achievement and mathematics achievement showed moderate correlations between $r = .31$ and $.49$.

No significant group differences were evident for the covariates. A marginal but nonsignificant difference was found for gender (χ^2 (1, $N = 1,062$) $= 3.33, p = .07$), with slightly more females in the internalizing problems group ($51 - 52.8\%$). Also, a marginal but nonsignificant difference was found for parents' occupational status (t (841) $= 1.42, p = .08$), and no significant group differences emerged for migration background (χ^2 (1, $N = 1,062$) $= 0.18, p = .68$).

Table 1

Correlation Matrix for Internalizing Problems and Outcomes

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
IP1	1																									
IP2	2	**.51**																								
RA 1	3	.01	-.05																							
RA 2	4	.00	**-.11**	**.61**																						
RA 3	5	-.01	**-.14**	**.62**	**.60**																					
RA 4	6	-.03	**-.09**	**.54**	**.56**	**.60**																				
MA 1	7	-.07	**-.13**	**.49**	**.38**	**.42**	**.38**																			
MA 2	8	-.06	**-.11**	**.45**	**.37**	**.38**	**.37**	**.66**																		
MA 3	9	-.03	**-.12**	**.44**	**.39**	**.47**	**.39**	**.66**	**.63**																	
MA 4	10	.00	**-.13**	**.39**	**.31**	**.43**	**.46**	**.54**	**.60**	**.63**																
SA 1	11	**-.56**	**-.38**	.02	**.06**	**.07**	.05	**.08**	.05	.04	.06															
SA 2	12	**-.42**	**-.66**	.02	**.08**	**.09**	.05	**.08**	.04	.03	**.11**	**.49**														
SA 3	13	**-.40**	**-.53**	.02	.10	**.12**	**.11**	.04	.05	.06	**.08**	**.45**	**.62**													
SA 4	14	**-.33**	**-.39**	.05	**.09**	**.07**	.06	.07	.06	.04	.03	**.36**	**.48**	**.54**												
PA 1	15	**-.11**	**-.12**	**.13**	**.12**	**.16**	**.13**	**.08**	**.08**	**.07**	.07	**.29**	**.15**	**.13**	**.16**											
PA 2	16	**-.15**	**-.17**	**.09**	**.09**	**.18**	**.10**	**.09**	**.06**	**.11**	**.08**	**.24**	**.18**	**.18**	**.23**	**.40**										
PA 3	17	**-.13**	**-.22**	**.09**	.08	**.18**	**.16**	**.09**	**.11**	**.09**	**.14**	**.29**	**.33**	**.33**	**.32**	**.49**	**.59**									
PA 4	18	**-.10**	**-.19**	**.10**	**.10**	**.15**	**.16**	**.08**	**.05**	**.07**	**.09**	**.21**	**.31**	**.29**	**.40**	**.43**	**.48**	**.72**								
TA 1	19	-.05	**-.07**	**.07**	.04	**.10**	**.12**	**.09**	.04	.06	**.10**	**.24**	**.18**	**.18**	**.15**	**.43**	**.22**	**.40**	**.37**							
TA 2	20	**-.10**	**-.18**	.05	.04	**.14**	**.10**	**.07**	.03	.01	.06	**.20**	**.21**	**.18**	**.12**	**.32**	**.36**	**.43**	**.32**	**.46**						
TA 3	21	-.06	**-.16**	.07	.03	**.10**	.07	.07	.04	.02	.07	**.22**	**.25**	**.21**	**.17**	**.35**	**.35**	**.55**	**.42**	**.55**	**.56**					
TA 4	22	**-.15**	**-.21**	**.10**	.03	**.10**	**.12**	**.10**	.06	.07	**.09**	**.24**	**.28**	**.24**	**.23**	**.34**	**.29**	**.48**	**.48**	**.47**	**.43**	**.61**				
RP 1	23	**-.34**	**-.37**	**.09**	.04	**.10**	.06	.00	.05	.01	.07	**.21**	**.30**	**.20**	**.23**	**.12**	**.11**	**.16**	**.14**	**.10**	**.11**	**.14**	**.17**			
RP 2	24	**-.23**	**-.38**	.06	**.09**	**.14**	**.13**	.00	.03	.04	.06	**.19**	**.30**	**.25**	**.23**	**.14**	.08	**.15**	**.14**	**.17**	**.11**	**.25**	**.19**	**.45**		
RP 3	25	**-.23**	**-.29**	**.09**	**.15**	**.17**	**.20**	.03	.04	**.12**	**.12**	**.16**	**.24**	**.29**	**.24**	.03	**.11**	**.10**	**.11**	**.11**	**.09**	**.11**	**.12**	**.36**	**.46**	
RP 4	26	**-.17**	**-.24**	**.09**	.06	**.13**	**.14**	-.03	-.01	.04	**.10**	.08	**.20**	**.20**	**.27**	.08	**.14**	**.16**	**.18**	.06	**.10**	**.14**	**.17**	**.30**	**.43**	**.51**

Note. IP = internalizing problems; RA = reading achievement; MA = mathematics achievement; SA = self-rated acceptance; PA = peer-rated acceptance; TA = teacher-rated acceptance; RP = relationship with parents. 1 = Grade 5; 2 = Grade 6; 3 = Grade 7; 4 = Grade 8. Values in bold are statistically significant $p < .05$.

Group Differences in Functioning at Fifth Grade

In order to provide an examination of mean-level differences over time and inter-individual differences, we first ran a growth curve analysis for a model without the distinction of internalizing problems versus no internalizing problems. Outcome means and variances at fifth grade and for mean level changes over time for the null model are presented in Table 2. Growth curve models were fitted separately for each outcome. Goodness of fit indices revealed a good fit for each outcome measure: reading achievement: χ^2 (11, N = 1,062) = 48.80, $p < .001$, CFI = .97, RMSEA = .06, SRMR = .03; mathematics achievement: χ^2 (11, N = 1,062) = 35.82, $p < .001$, CFI = .98, RMSEA = .05, SRMR = .02; self-rated acceptance: χ^2 (11, N = 1,062) = 42.62, $p < .001$, CFI = .96, RMSEA = .06, SRMR = .07, peer-rated acceptance: χ^2 (11, N = 1,062) = 50.78, $p < .001$, CFI = .94, RMSEA = .07, SRMR = .04; teacher-rated acceptance: χ^2 (11, N = 1,062) = 25.61, $p < .01$, CFI = .97, RMSEA = .04, SRMR = .03; relationship with parents: χ^2 (11, N = 1,062) = 13.96, $p = .24$, CFI = .99, RMSEA = .02, SRMR = .04.

Table 2

Means and Variances at Fifth Grade and for Mean Level Changes over Time for the Null Model

	Intercept		Slope	
Outcomes	Mean	Variance	Mean	Variance
Reading achievement	.33*	.63***	.26***	.04**
Mathematics achievement	.92***	.71***	.40***	.04***
Self-rated acceptance	2.92***	.26***	.08	.02**
Peer-rated acceptance	3.37***	.41***	.18***	.01***
Teacher-rated acceptance	3.21***	.33***	.02	.01*
Relationship with parents	4.31***	.24***	.11*	.04***

Note. *$p \le .05$, **$p \le .01$, ***$p \le .001$.

The results presented in Table 2 suggest that students showed a significant amount of variance in all investigated outcomes at fifth grade and further exhibited inter-individual differences in change over time. Specifically, students' reading achievement increased significantly over time, as did their mathematics achievement. Self-rated acceptance did not show significant growth over time. A significant positive growth over time was observed for students' peer-rated acceptance scores. There was no significant change over time for teacher-rated acceptance. Finally, we observed significant negative growth over time with regard to relationship with parents.

In order to examine how much of the observed change could be explained by students' internalizing problems, we subsequently included the information on internalizing problems in the model. A comparison of goodness of fit indices revealed that the differentiation model showed an excellent model fit (see Table 3). Table 4 presents the means, variances, and group differences at fifth grade. All outcomes revealed a substantial variability of intercepts. Significant differences were found between students with versus without impairment at fifth grade for all of the six investigated outcomes[1]. More precisely, students with internalizing problems had significantly lower scores in all areas of functioning.

Table 3

Model Fit Indices for the Differentiation Model for each Outcome

Outcome	χ^2	df	p	RMSEA	CFI	SRMR
Reading achievement	50.434	13	<.001	.059	.966	.026
Mathematics achievement	35.192	13	<.001	.045	.983	.022
Self-rated acceptance	48.699	13	<.001	.057	.960	.067
Peer-rated acceptance	60.517	13	<.001	.066	.947	.040
Teacher-rated acceptance	31.069	13	<.01	.041	.978	.027
Relationship with parents	14.466	13	.3419	.012	.998	.037

With regard to the investigated academic outcomes, reading achievement and mathematics achievement, we found that students with internalizing problems showed significantly lower achievement scores than students without internalizing problems at fifth grade. For reading achievement and mathematics achievement, effect sizes were $d = 0.21$ and $d = 0.32$, respectively. Students with internalizing problems reported significantly lower levels of self-rated acceptance than students without such problems ($d = 1.77$). Similarly, peer-rated acceptance scores were significantly lower for those with versus those without internalizing problems, indicating that students with internalizing problems were less liked by their classmates ($d = 0.53$). Teacher-rated acceptance scores showed a similar pattern, with significantly lower teacher-rated acceptance scores for students in the internalizing problems subgroup ($d = 0.27$). Finally, students with internalizing problems yielded significantly lower scores on the relationship with parents scale than students without internalizing problems ($d = 1.23$).

In sum, differences in functioning in students with versus without internalizing problems at fifth grade emerged for all of the investigated academic and social outcomes, with students with internalizing problems scoring significantly lower in all domains of functioning. Cohen's *d* analyses suggest effects of small to large magnitude.

Table 4

Means, Variances, and Group Differences at Fifth Grade and for Mean Level Changes over Time for a Model Including the Group Differentiation

Outcomes	Intercept				Slope		
	Mean	Variance	Δ		Mean	Variance	Δ
Reading achievement	.38**	.63***	-.16*		.29***	.04**	-.09*
Mathematics achievement	1.00***	.70***	-.27***		.40***	.04***	.00
Self-rated acceptance	3.12***	.16***	-.71***		.06	.01***	.06*
Peer-rated acceptance	3.46***	.40***	-.33***		.19***	.04***	-.03
Teacher-rated acceptance	3.26***	.33***	-.15*		.04	.01*	-.07**
Relationship with parents	4.46***	.19***	-.53***		-.12**	.04***	.04

Note. *p ≤ .05, **p ≤ .01, ***p ≤ .001.

Group Differences in Students' Academic and Social Development over Time

In order to investigate the scar model, we tested group differences in change over time, and found that group differences emerged for several of the outcomes[2] (Table 4). Figure 1 depicts the predicted mean trajectories (controlling for covariates) over time for all investigated outcomes.

The difference of the slopes in reading achievement for individuals with versus those without internalizing problems was statistically significant ($d = 0.42$). The trajectories for reading achievement showed positive growth in both groups from fifth to eighth grade but the increase in the slope was less positive for students with internalizing problems. There was no significant slope difference in mathematics achievement between students with versus without internalizing problems. The slopes for mathematics achievement showed positive growth for both groups. A statistically significant difference between the groups emerged for the slopes of self-rated acceptance over time ($d = 0.51$). Specifically, growth of slopes was positive for both groups but more positive for those with internalizing problems. There were no differences in slopes for peer-rated acceptance between the groups. The positive growth for students in both groups did not differ significantly. The differences in magnitude of slopes for teacher-rated acceptance differed significantly ($d = 0.61$). Whereas the slope for students with no internalizing problems showed a positive growth over time, growth in slope for those with internalizing problems was negative. No significant slope differences between groups emerged for the relationship with parents over time, ratings on the relationship with parents subscale decreased for both students with versus without internalizing problems.

To summarize, differences in functioning between students with versus without internalizing problems emerged for three of the investigated academic and social outcomes over time, thus providing some support for the scar model. More precisely, students with internalizing problems showed less positive growth in reading, more positive growth in self-rated acceptance, and negative growth in teacher-rated acceptance. Cohen's *d* analyses suggest effects of medium to large magnitude.
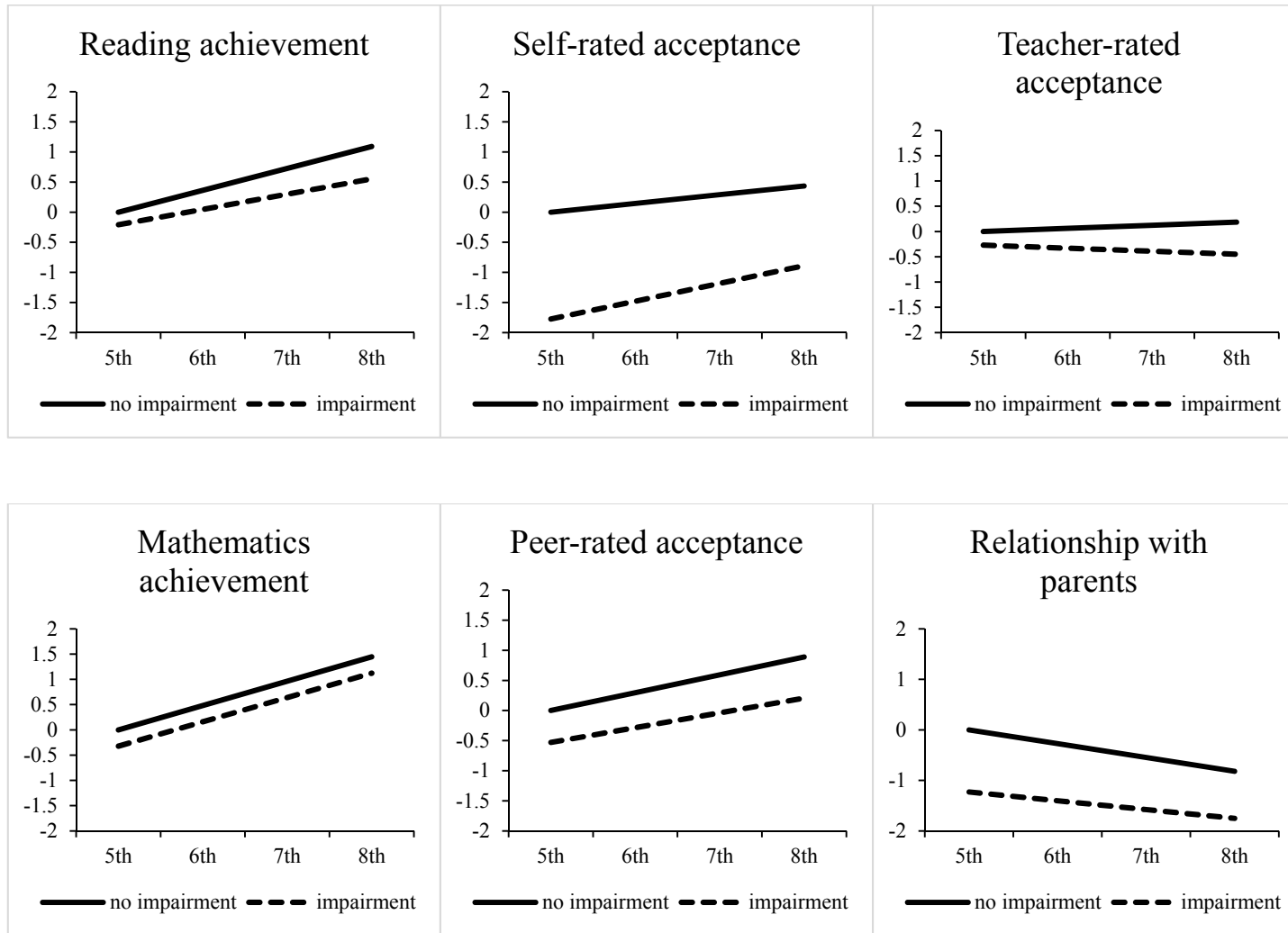
Figure 1. Predicted average trajectories for the investigated outcomes (controlled for the covariates). Significant trajectory differences are depicted in the first row, nonsignificant ones in the bottom row.

Discussion

Adolescents are faced with considerable changes and challenges as they transition from childhood to adulthood. Not only is the transition marked by a host of significant emotional, cognitive and physiological changes (Yurgelun-Todd, 2007), it also is a time during which the importance of peer relations and independence from parents increase (La Greca, & Harrison, 2005). Whereas the transition takes a normative developmental course for the majority of adolescents, a substantial number of adolescents, however, deal with pronounced emotional and social difficulties, including internalizing problems (Graber & Sontag, 2009). The high prevalence rates in the student population and the stability of these problems over time (Graber & Sontag, 2009) raise the question of how internalizing problems impact said functioning domains.

Theoretically based on the scar model (i.e., the notion that internalizing problems precede functioning difficulties), the main results of the current study are as follows: First, at Grade 5, youth with internalizing problems had significantly lower scores compared to non-impaired youth in all of the six investigated functioning domains. Second, differences in change over time between those with versus without internalizing problems emerged for three of the six investigated outcomes, namely reading achievement, self-rated acceptance, and teacher-rated acceptance. In the following discussion, we first describe the results for the group differences in the investigated functioning domains at fifth grade, and subsequently discuss group differences in adolescents' academic and social development over time.

Differences in Academic and Social Functioning at Fifth Grade between Adolescents with versus without Internalizing Problems

Considering the finding that adolescents with internalizing problems at fifth grade revealed significantly lower scores on all six of the investigated outcomes suggests that these adolescents are at a significant developmental disadvantage at earlier stages of their lives. It is noteworthy that the disadvantages for youth with internalizing problems are observable across both academic (reading achievement, mathematics achievement) and social functioning (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) domains. Largest effect sizes emerged for students' self-reported social functioning (i.e., self-rated acceptance, relationship with parents). These very large effect sizes indicate that the differences between students with internalizing problems and those without are especially pronounced in students' perceived social functioning domains.

There are several potential explanations for the present results. First, previous research has emphasized the importance of early family and school environments as important predictors of cognitive but also non-cognitive development (Heckman, 2006). Children with internalizing problems who were faced with early disadvantages might not be able to compensate for their lack of skills or opportunities, thus resulting in persistent functioning problems that remain present in secondary school and are possibly maintained in later life. This assumption is underscored by studies that suggest poorer school transition in those with depression or low self-esteem which have negative long-term implications for mental health (Hirsch & Rapkin 1987; West, Sweeting, & Young, 2010). Second, it is important to consider the significance of the transition from primary to secondary education. Not only are students faced with new educational demands after changing schools, they are also exposed to more (and older) students, may experience a harder time making friends, and are confronted with several other challenges (Anderson, Jacobs, Schramm, & Splittgerber, 2000; Bilz, 2008). Also, Gray (1972) found that particularly children who exhibit behavioral inhibition (i.e. withdrawn or avoidant behavior, negative emotional states, and negative verbal and non-verbal expression) tend to experience adjustment difficulties at the beginning of secondary school. Similarly, West and colleagues (2010) found that anxious adolescents or those with lower self-esteem experienced poorer school transitions in general or with regard to their peer social system. In line with these findings, the results of the present study suggest that youth with difficulties in the internalizing spectrum experience worse transitions from primary to secondary schools than students without such impairment, thus resulting in more negative adjustment in all investigated academic and social functioning domains.

In summary, our finding that fifth grade students with elevated internalizing symptom levels show significant disadvantages in all investigated academic and social functioning domains compared to other students is highly concerning. Early disadvantaged environments as well as worse transitioning experiences from primary to secondary school for those with internalizing problems may serve to explain this finding.

Differences in Change over time between Adolescents with versus without Internalizing Problems

Aligned with the proposition of the scar model, our data also provided evidence for differences in change over time in three of the six investigated functioning domains. Specifically, reading achievement showed less positive growth over time in adolescents with internalizing problems than in those without internalizing problems. Conversely, self-rated acceptance growth, though positive for both groups, was more positive for adolescents with

internalizing problems than for those without. The last significant difference emerged for teacher-rated acceptance. Precisely, growth for teacher-rated acceptance was negative for those scoring above the cutoff for internalizing problems and positive for those scoring below the cutoff. No significant differences between those with and those without internalizing problems emerged for mathematics achievement, peer-rated acceptance, and relationship with parents.

Although reading achievement increased for all students over time, the increase was less positive for students with internalizing problems at fifth grade. This finding aligns with the observation that several main symptoms of depression (i.e., loss of interest, difficulties in concentration, and poor initiative) may significantly diminish cognitive performance and learning (Beck, 1967; Fröjd et al., 2008). Kovacs and Goldston (1991) have argued that depressed youth show a mild decline in their tested verbal performance over time, a finding that may serve to explain why there was a significant difference in reading achievement but not mathematics achievement. Moreover, observations from previous research that emphasize the importance of literacy opportunities at home could also serve to explain this finding. Specifically, earlier studies have shown that the home environment plays an important role in the development of word decoding (Baker, Fernandez-Fein, Scher, & Williams, 1998; Cunningham & Stanovich, 1998) as well as vocabulary, conceptual knowledge, and language comprehension (Bus, van IJzendoorn, & Pellegrini, 1995). Furthermore, De Jong and Leseman (2001) found that parents' instructional and social-emotional quality had an effect on the development of reading comprehension, suggesting that early family environments play a key role in the acquisition of reading skills. Concluding from our data, the disadvantage in reading achievement for students with internalizing problems cannot be compensated by schools and becomes more pronounced over time into secondary education.

For mathematics achievement, no significant differences emerged between adolescents with or without internalizing problems. Whereas early literacy opportunities at home seem to play a key role in successful development of reading and language comprehension skills, the role of enhancing mathematics achievement might lie to a larger extent in school. Thus, whereas differences between impaired and non-impaired students in their language ability may emerge at a very young age—thus impacting reading achievement—mathematics skills are taught in school to a far greater extent. Thus, this may explain why the influence of the home environment might be less pronounced for mathematics than for reading.

For the self-rated acceptance, we found that adolescents with internalizing problems had a more positive growth in their acceptance scores than those without internalizing problems, suggesting a compensatory development in adolescents with internalizing problems. It is

important to consider the possibility that adolescents with internalizing problems draw on social resources outside of the classroom. Friendships outside of the class or school may provide sufficient support even during the school day and can serve to compensate for potential peer difficulties at school. Moreover, we cannot know whether the perception of what entails a friendship or of being included differs between those with internalizing problems and those without. Here, it is very important to consider the possibility that adolescents with internalizing problems have a different internal definition of inclusion or friendship than their non-impaired peers. Maybe having just one good friend in class and forming a close dyad with them is sufficient for an adolescent with internalizing problems to not feel like an outsider. In this context, the assessment of only one's classmates as a reference group bears the potential to neglect that one might have friends and support in other classes or schools (e.g., neighborhood friends; Asher, Hymel, & Renshaw, 1984).

The lack of differences in change over time for peer-rated acceptance suggests that the initial fifth grade disadvantage for students with internalizing problems remains even though the change over time is positive, indicating that acceptance increases. This finding is in line with a study by Brendgen, Vitaro, Turgeon, and Poulin (2002) who, assessing a sample of fourth through sixth graders, found that from the peer perspective students who were depressed did not experience significant difficulties in peer relations or dyadic friendships. In fact, depressed students were rather comparable to well-adjusted students in regard to their peer relations. On the contrary, students with aggressive problems were significantly less liked by their peers than well-adjusted students. Other research also suggests that it is especially those with externalizing behavior problems who are less liked by peers (e.g., Hoza et al., 2005; see Newcomb, Bukowski, & Pattee, 1993, for a meta-analytic review).

The adult perception of an adolescent's acceptance in class shows a difference between students with and those without internalizing problems. Precisely, teachers rated their students who did not start with internalizing problems more positively over time, and their students with internalizing problems more negatively over time. It might be that teachers, who watch their students develop over time and view this development from an adult perspective, are especially sensitive to an adolescent's acceptance in class. Also, teachers are more likely to judge each individual student in reference to the system he or she sees the student interact in, i.e., the entire class. Compared to a student who might be happy with having just one or two friends in class, the teacher might focus more on the actual reference group (i.e., the classmates) and rate such a student as an outsider. To disentangle the differences in these acceptance ratings, further

studies are necessary, specifically such investigating very precisely the actual peer networks including number of friends.

Finally, we found a decline from fifth to eighth grade in the relationship with parents. However, the decline was not different for adolescents with versus without internalizing problems, which is indicative of a persisting disadvantage for students with internalizing problems. This pattern of results underlines the general deterioration in communication between adolescents and their parents during the time of adolescence (La Greca & Prinstein, 1999).

Taken together, our results suggest that shortly after the transition to secondary school, adolescents with internalizing problems are already at a significant disadvantage in all investigated functioning domains, potentially due to early manifested adjustment difficulties as well as more negative transitioning experiences compared to those without internalizing problems. The nonsignificant results for mathematics achievement, peer-rated acceptance and relationship with parents in our change over time analyses suggests that adolescents stay at this disadvantage over time. In fact, the gap between those with and without internalizing problems widens even more for reading achievement and teacher-rated acceptance. Only with regard to self-rated acceptance did the adolescents with internalizing problems show a more positive development than those without internalizing problems over time.

Limitations

The current study has many strengths including the longitudinal design, the rigorous test of the scar model, the multi-informant approach, and the large sample of students first assessed right after an important transition from primary school to secondary school. Nevertheless, several limitations of the present study warrant attention.

First, it is important to note that the categorization of internalizing problems was based on students' self-reports in a questionnaire. Although clinical interviews may have provided an opportunity to determine whether students met actual DSM-V diagnoses, their utilization would have been extremely labor-intensive and associated with high additional costs. The use of the YSR to determine internalizing problems in the current study allowed for an examination of a large sample of students at four measurement points over three years.

Second, it should be mentioned that no students from the highest German school track (i.e., the Gymnasium) participated in the present study. Our sample included students from intermediate- or lower-track schools, thus the results should not be generalized to higher-track students. However, previous research has underscored the significance of internalizing problems, particularly depressive symptoms, in lower- and intermediate-track students (Fend &

Schröer, 1990) as these students are at increased risk for the development of depressive disorders than students who attend a Gymnasium.

Third, although our sample consisted of a representative sample of the target population, it should be noted that our study investigated students from one specific area (the German state of Saxony) and that only 5.3% of the sample had an immigrant background. Although we controlled for immigrant background, from the low diversity in this sample it is unclear to what extent local or cultural differences may affect the association between internalizing problems and academic and social functioning. Although we are not aware of previous research that documented major differences in the relationship between internalizing problems and functioning in different areas of Germany or across cultures (e.g., the United States), studies with a more diverse sample or cross-cultural studies might detect such differences.

Finally, we were able to collect data once annually from students, peers, and teachers over a time period of three years. However, more fine-grained analyses with shorter measurement intervals may be desirable in future studies.

Conclusion

In sum, the current study provides important novel insights regarding the debilitating influence of internalizing problems on academic and social functioning in adolescence immediately after the transition to secondary education and over time. The findings highlight the significant disadvantages students with internalizing problems experience across all investigated academic and social functioning domains compared to students without internalizing problems at the beginning of secondary school. These gaps in functioning between students calls for the development and implementation of effective early support or indicated prevention programs already in primary school. Although over time, students with internalizing problems improve in their self-rated acceptance compared to non-impaired students, they fail to compensate for early disadvantages in secondary school in all other functioning domains, and the gap even widens for reading achievement and teacher-rated acceptance. Accordingly, in order to prevent long-term manifestation of early disadvantages, schools should focus on special support for students who enter secondary school with internalizing problems.

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Footnotes

[1]The results remained the same if the 5% or 10% of students with the highest internalizing problems score at T1 and T2 were classified as the internalizing problems group. Effect sizes for significant group differences in functioning at fifth grade with a 5% cutoff: reading achievement $d = 0.23$; mathematics achievement $d = 0.19$; self-rated acceptance $d = 2.07$; peer-rated acceptance $d = 0.63$; teacher-rated acceptance $d = 0.49$; relationship with parents $d = 1.59$. Effect sizes for significant group differences in functioning at fifth grade with a 10% cutoff: reading achievement $d = 0.24$; mathematics achievement $d = 0.33$; self-rated acceptance $d = 1.82$; peer-rated acceptance $d = 0.63$; teacher-rated acceptance $d = 0.40$; relationship with parents $d = 1.37$.

[2]The results remained the same if the 5% or 10% of students with the highest internalizing problems score at T1 and T2 were classified as the internalizing problems group. Effect sizes for significant group differences in students' academic and social development over time with a 5% cutoff: reading achievement $d = 0.24$; self-rated acceptance $d = 0.56$; teacher-rated acceptance $d = 0.47$. Effect sizes for significant group differences in students' academic and social development over time with a 10% cutoff: reading achievement $d = 0.17$; self-rated acceptance $d = 0.58$; teacher-rated acceptance $d = .44$.

7   STUDY 2

MODERATORS OF THE EFFECTS OF INDICATED GROUP AND BIBLIOTHERAPY COGNITIVE BEHAVIORAL DEPRESSION PREVENTION PROGRAMS ON ADOLESCENTS' DEPRESSIVE SYMPTOMS AND DEPRESSIVE DISORDER ONSET

Abstract

We investigated factors hypothesized to moderate the effects of cognitive behavioral group-based (CB group) and bibliotherapy depression prevention programs. Using data from two trials ($N = 631$) wherein adolescents (M age = 15.5, 62% female, 61% Caucasian) with depressive symptoms were randomized into CB group, CB bibliotherapy, or an educational brochure control condition, we evaluated the moderating effects of individual, demographic, and environmental factors on depressive symptom reductions and major depressive disorder (MDD) onset over 2-year follow-up. CB group and bibliotherapy participants had lower depressive symptoms than controls at posttest but these effects did not persist. No MDD prevention effects were present in the merged data. Relative to controls, elevated depressive symptoms and motivation to reduce depression amplified posttest depressive symptom reduction for CB group, and elevated baseline symptoms amplified posttest symptom reduction effects of CB bibliotherapy. Conversely, elevated substance use mitigated the effectiveness of CB group relative to controls on MDD onset over follow-up. Findings suggest that both CB prevention programs are more beneficial for youth with at least moderate depressive symptoms, and that CB group is more effective for youth motivated to reduce their symptoms. Results also imply that substance use reduces the effectiveness of CB group-based depression prevention.

Keywords: depression, prevention, adolescence, cognitive-behavioral, moderator

Moderators of the Effects of Group and Bibliotherapy Cognitive Behavioral

Depression Prevention Programs on Depressive Symptoms and Depressive

Disorder Onset

Depression is one of the most prevalent psychiatric disorders experienced by adolescents and often recurs during adulthood (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Adolescent depression is associated with suicidal behavior, substance abuse, interpersonal problems, academic failure, and comorbid psychopathology (e.g., Klein, Torpey, & Bufferd, 2008). Despite the significance of depressive disorders, less than 50% of depressed adolescents receive treatment (Kessler, Avenevoli, & Ries Merikangas, 2001), suggesting the need for effective depression prevention programs that could be widely implemented.

Various cognitive-behavioral (CB) depression prevention programs have reduced depressive symptoms and future depressive disorder onset in adolescents, but the average magnitudes of effect have been small to moderate, with smaller average effects for universal versus selective or indicated programs (Horowitz & Garber, 2006; Stice, Shaw, Bohon, Marti, & Rohde, 2009). However, the effectiveness of such programs can vary considerably depending on individual, environmental, and demographic factors, highlighting the need to investigate potential moderators of depression prevention program effects, a central concept in personalized medicine. Moderational analyses are important for several reasons. First, knowledge about moderators provides information regarding the conditions under which optimal prevention effects occur. Second, neglecting potential moderators of prevention effects can lead to misinterpretation of results (Tram & Cole, 2000). Third, determining which individuals are most or least likely to benefit from an intervention can inform optimum inclusion and exclusion criteria. For instance, through moderation analyses youth that are unlikely to benefit from a specific prevention program or even experience iatrogenic effects can be identified, and this may provide direction regarding alternative intervention for those individuals. Fourth, moderation analyses may also lead to program refinement because important aspects that contribute to the effectiveness of a program for a specific population can be discovered. Conversely, documenting that there are few moderators for an intervention in an adequately powered evaluation would suggest that the intervention is effective for a broad range of individuals and could be widely implemented. Information about all of these

aspects helps to maximize economical and cost-effective program dissemination. Thus, moderators can serve to provide specific, novel, and valuable information which guides future modification of intervention decision making and program development.

We examine potential moderators of the effects of a 6-hour CB depression prevention group program and an individual CB bibliotherapy program relative to an educational brochure control condition and to each other among adolescents with elevated depressive symptoms. The approach taken has several strengths that allow us to extend previous literature. First, by examining two active interventions relative to each other and a control condition, it is possible to directly compare which of the two active interventions works best for participants with certain characteristics. Second, the availability of data through 2-year follow-up makes it possible to identify moderators that affect program effects on a long-term basis. Third, by focusing on two outcomes – depressive symptom severity and major depressive disorder (MDD) onset – we evaluate potential subgroup effects on two critical prevention outcomes. Whereas depressive symptom severity as an outcome has been investigated in several moderation studies (e.g., Curry et al., 2006; Garber et al., 2009; Gau, Stice, Rohde, & Seeley, 2012), to our knowledge, only one previous study has examined moderators of the effect of depression prevention programs on depressive disorder onset (Garber et al., 2009); these investigators examined whether current parental depression, current adolescent depressive symptoms and adolescent history of mood disorder moderated the impact of CB prevention on depressive disorder onset, finding that current parental depression reduced the efficacy of CB group, a moderating effect that persisted over follow-up (Beardslee et al., 2013). Although reduction of depressive symptoms is an important objective of depression prevention programs especially in selective and indicated programs, the ultimate goal of depression prevention efforts is the prevention of depressive disorder onset. Therefore, it is vital to extend previous literature examining moderators of depressive symptom reductions by also investigating moderators of depression onset. Fourth, as previous moderation analyses have generally been conducted with data from a single trial and subsequently had limited power to identify moderators, we created a merged data set from a large efficacy trial (Stice, Rohde, Seeley, & Gau, 2008) and a large effectiveness trial (Rohde, Stice, Shaw, & Brière, 2014). Merging data sets provides us with the opportunity to investigate moderating effects of the depression prevention programs on MDD onset in a more adequately powered sample. Merging data results in higher statistical power from

larger sample size and a greater representation of specific subgroups and risk factors. This maximizes sensitivity to detect moderating effects. Furthermore, pooling data from multiple trials provides a cost- and resource-effective alternative to gather information prior to collecting new data on the effectiveness of a specific program.

The efficacy trial investigated a 6-hour CB depression prevention group program, an individual CB bibliotherapy program, and a supportive-expressive group intervention versus an educational brochure control condition in 341 adolescents with elevated depressive symptoms (Stice, Rohde, et al., 2008). At posttest, CB group participants showed significantly greater depressive symptom reductions than participants in all other conditions. All three interventions led to significantly greater symptom reductions versus controls at 6-month follow-up. By 1-year follow-up, participants in the CB group showed significantly greater symptom reductions than controls and by 1- and 2-year follow-up also compared to CB bibliotherapy but not to supportive-expressive group participants. By 2-year follow-up, CB group and CB bibliotherapy participants showed significantly lower rates of major/minor depressive disorder onset than controls (Stice, Rohde, Gau, & Wade, 2010). The effectiveness trial tested whether the effects of these two CB prevention programs remained, relative to educational brochure controls, when school clinicians recruit adolescents with depressive symptoms and deliver the interventions under ecologically valid conditions with 378 adolescents with elevated depressive symptoms (Rohde, Stice, Shaw, & Brière, 2014). CB group participants scored lower on depressive symptoms than controls at posttest. By 6-month follow-up CB group participants showed a significantly lower MDD onset relative to bibliotherapy and control participants; this effect was maintained by 2-year follow-up comparing CB group to CB bibliotherapy, though the difference compared to controls did not reach significance (Rohde, Stice, Shaw, & Gau, in press).

The combined sample for this study included data from 631 participants assigned to three conditions (we did not include those randomized to supportive-expressive group because that condition was not included in the effectiveness trial) from 11 high schools in 2 regions of the US. We examine eight potential moderators of the effects of CB interventions on depressive symptoms: four individual factors (depressive symptom severity, substance use, motivation to reduce depression, attributional style), two sociodemographic factors (sex, age), and two environmental factors (social support from friends and family, negative life events).

Individual factors. First, we hypothesized stronger intervention effects for youth with higher initial depressive symptoms. Meta-analyses indicate that programs targeting participants with high initial symptoms typically produce stronger depressive symptom reductions than universal programs (Horowitz & Garber, 2006; Stice et al., 2009). Individual trials have also found that symptom reductions in prevention trials are stronger for participants with high versus low baseline symptoms (e.g., Jaycox, Reivich, Gillham, & Seligman, 1994; Spence, Sheffield, & Donovan, 2003; Tandon et al., 2015; Wilksch & Wade, 2014). Theoretically, those with elevated symptoms have greater potential to show symptom reductions. Moreover, those youth who already suffer from high depressive symptoms at baseline are able to apply the skills taught in the CB programs to their current negative mood state and cognitions, and are also more likely to experience a higher level of suffering which should lead to greater motivation to work on reducing their symptoms. Second, we anticipated stronger effects for participants with more initial motivation to reduce depressive symptoms. Readiness to change should provide motivation to participate in the program exercises and homework assignments, which should promote skill acquisition (Stice, Marti, Shaw, & O'Neil, 2008). Trials with various psychiatric disorders in adults have found that high motivation to reduce initial symptoms predicts participants' treatment response (Keijsers, Schaap, Hoogduin, Hoogsteyns, & de Kemp, 1999) and that adolescents with higher motivation during participation in a depression prevention program experienced greater depressive symptom reductions at follow-up (Kindt, Kleinjan, Janssens, & Scholte, 2014). In our efficacy prevention trial, motivation to reduce depressive symptoms did not moderate program effects (Gau et al.,2012), but we expect that the larger data set used for this report will provide a more sensitive test of this potential moderator. Third, we hypothesized that substance use would moderate CB intervention effects with concurrent substance users benefitting less from the CB intervention than non-users. Depressive symptoms and substance use are correlated in youth (O'Neil, Conner, & Kendall, 2011) and substance use may contribute to depression onset and maintenance, possibly reducing participants' motivation to apply the skills taught in the program (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Rohde, Lewinsohn, Kahler, Seeley, & Brown, 2001). Moreover, substance use predicted a poorer response to CB treatment in depressed adolescents (Gilbert, Fine, & Haley, 1994; Rohde et al., 2001). Fourth, we anticipated that negative attributional style would moderate the effects of CB programs, as those with a more negative attributional style would

theoretically benefit more from the cognitive restructuring element of the CB interventions. In support, one depression treatment trial found that negative cognitive distortions moderated treatment outcomes (Curry et al., 2006) and another found that high and average baseline levels of hopelessness, a related concept, moderated intervention effects on depressive symptoms (Gillham et al., 2012).

Demographic factors. We hypothesized that sex would moderate the effects of the CB programs with females benefitting more from participation than males. Though the opposite pattern has emerged in some studies, depression prevention programs and interventions have generally produced stronger effects for females versus males in meta-analyses (Horowitz & Garber, 2006; Stice et al., 2009) and single trials (e.g., Donker et al., 2013; Gillham, Hamilton, Freres, Patton, & Gallop, 2006; Seligman, Schulman, DeRubeis, & Hollon, 1999). Theoretically this pattern of effects has emerged because female adolescents are approximately twice as likely to develop MDD (Nolen-Hoeksema & Girgus, 1994) and report greater depressive symptoms than male adolescents (e.g., Castelao & Kröner-Herweig, 2013). We also expected that CB program effects would be larger for older versus younger participants based on meta-analytic findings (Horowitz & Garber, 2006; Stice et al., 2009) and single trials (e.g., Stasiak, Hatcher, Frampton, & Merry, 2014). Older adolescents may have struggled with depressive symptoms for a longer duration, which might improve engagement in the interventions, and younger adolescents may have more difficulty understanding and implementing the CB skills conveyed in these programs.

Environmental factors. We hypothesized that individuals with less social support from parents and peers would show significantly greater depressive symptom reductions if they participated in the CB group intervention as previous research found that adolescents who experience low levels of parental support showed small but significant reductions in depressive symptoms if they had participated in a universal depression prevention program versus a control condition (Spence et al., 2014). Our hypothesis is further based on evidence that low social support increases the risk for depression in adolescents and young adults (Lewinsohn et al., 1994; Sheeber, Hops, & Davis, 2001). Finally, we hypothesized that elevated negative life events would mitigate CB program effects, based on previous trials indicating that negative life events reduced the effects of a CB group program (Gau et al., 2012) and predicted poorer response to CB treatment for depression in adults (Jayson, Wood, Kroll, Fraser, & Harrington, 1998). Even though

strategies to detect and restructure negative thoughts regarding negative life events, and encouragement to engage in pleasant activities are major aspects of CB programs, we assume that the unfavorable effects of negative life events cannot completely be countered in relatively short prevention efforts.

In addition to investigating moderators of the effects of CB interventions on depressive symptoms, we also tested whether these factors moderated the effects of the two CB interventions on MDD onset. We expect the direction of moderation hypotheses of CB group and bibliotherapy on MDD onset to be the same as moderators on depressive symptoms for all of the examined factors. Specifically, we hypothesized that higher initial depressive symptoms, motivation to reduce depression, negative cognitive style, as well as female sex, older age, and lower social support, negative life events and substance use would lead to greater differences in MDD onset between CB intervention and control group participants.

Method

Participants and Procedure

For this report, we combined data from an efficacy trial (trial 1; Stice, Rohde, et al., 2008) and an effectiveness trial (trial 2; Rohde, Stice, Shaw, & Brière, 2014) involving high school students. In total, 631 participants between 13 and 19 years of age at pretest (*M* age = 15.5, *SD* = 1.20; 62% female) were randomized to one of the three conditions. The combined sample was composed of 2% Asian/Pacific Islander, 5% African American, 17% Hispanic, 1% Native American, 61% Caucasian, and 14% who specified other or mixed racial heritage. Parental education was 25% high school graduate or less, 24% some college, 32% college graduate, and 19% advanced graduate/professional degree. Thirty-three percent had received treatment in the 12-month period prior to enrollment. Rates of treatment did not differ by condition but were significantly higher in Study 2 (72% vs. 63%).

Participants were recruited at schools using direct mailings, flyers, and posters inviting students who experienced sadness to participate in a research study aiming to improve current and future mood and promote emotional well-being. Recruitment occurred between 2004-2007 (trial 1) and 2009-2011 (trial 2). Recruitment letters included a study description, consent forms and a 1-page screen assessing depressive symptoms using the Center for Epidemiologic Studies-Depression Scale (CES-D;

Radloff, 1977) in trial 1, and a simplified 2-point response choice version in trial 2 (rarely/a little vs. occasionally/most of the time). Students who returned a signed consent form and scored 20 or above on the CES-D (trial 1) or endorsed two or more symptoms (trial 2) were invited to a pretest assessment with research staff to obtain baseline data and assess exclusion criteria (we could not estimate differences in CES-D levels for Studies 1 and 2 because the screener was completed in Study 2 prior to consent). All participants were given treatment referral information at study entry and advised to seek treatment if their symptoms escalated. Students who met criteria for MDD or acute suicidal ideation ($n = 111$) at pretest were excluded and project staff spoke with the student and contacted the parents to contract for safety, reiterate the importance of seeking treatment, and provide additional referral information.

All participants ($N = 631$) were randomly assigned to condition within blocks created by sex and school to one of the conditions: (a) CB group ($n = 215$), (b) CB bibliotherapy ($n = 208$), or educational brochure control ($n = 208$). They completed a survey and diagnostic interview at pretest, posttest, 6-month follow-up, 1-year follow-up, and 2-year follow-up (trial 1) and at the same timepoints with an additional 18-month follow-up in trial 2. They were paid for completing assessments. Assessments and groups were conducted at schools. The local institutional review boards approved this project.

Intervention Groups

CB group depression prevention program. The CB group program was identical in both trials, with the exception of a more scripted manual for facilitators in trial 2. The 6 weekly 1-hr sessions were conducted in single-sex groups of 5-9 participants at schools. Sessions focused on establishing group rapport, enhancing participants' engagement in pleasant activities (e.g., generating a personal list of fun activities, rewards for engaging in these activities), and identifying negative cognitions in order to replace them with more positive ones (e.g., strategies such as "Where's the Evidence?"). Motivational enhancement exercises, behavioral exercises, and group activities were used to support skill acquisition. Exercises were conducted in sessions (to apply the skills taught in the program) and as homework (to encourage participants to apply the skills in their daily life). Research clinicians facilitated groups in trial 1; school counselors or nurses facilitated groups in trial 2. If a participant missed a session, a brief (10-15 min) individual make-up session was conducted. Intervention content and facilitator training/supervision

is presented in detail elsewhere (Rohde, Stice, Shaw, & Brière, 2014; Stice, Rohde, et al., 2008).

CB bibliotherapy. Participants in CB bibliotherapy were provided with the book *Feeling Good* (Burns, 1980) which is the only self-help book that met the criterion for probably efficacious treatment of depression (Malouff & Rooke, 2007) and has successfully been used in previous bibliotherapy studies for the treatment and prevention of depression in adults and adolescents (Gregory, Schwer Canning, Lee, & Wise, 2004; Jamison & Scogin, 1995). It provides relevant and practical CB techniques for preventing and reducing negative moods. Written at a high-school reading level, the book covers topics such as understanding feelings of sadness, building self-esteem, overcoming guilt, and coping with stress. Participants were told, "This book has been shown to be helpful to some individuals who are feeling sad or depressed. This copy is yours to keep, so feel free to write or highlight in it as you read. We encourage you to use this as a self-help resource." In an effort to encourage utilization of the book, the school personnel in trial 2 were asked to make two brief scripted reminder phone calls to CB bibliotherapy participants encouraging them to continue or start reading the book and to complete as many exercises in the book as possible, but we did not track reminder calls.

Educational brochure control condition. Participants were given a National Institute of Mental Health brochure at pretest that describes depression and recommends treatment for depressed youth (National Institute of Mental Health, 2001), and information about local treatment options (as were all participants). Participants in this condition completed the same assessments as those in the other conditions, enabling us to monitor depression and suicidal ideation, and contact parents to provide treatment referrals as needed (done in all conditions). Participants and their parents were asked to contact research staff if they believed that the youth's symptoms had worsened.

Measures

Depressive symptoms. Depressive symptoms were assessed by research staff using 16 items from the semistructured Schedule for Affective Disorder and Schizophrenia for School-Age Children (K-SADS; Puig-Antich & Chambers, 1983). No other parts of the K-SADS were administered in this study. Participants indicated the severity of each symptom over their lifetime (trial 1) or the past 12 months (trial 2) at baseline and since the last assessment on a monthly basis at subsequent assessments (trials 1 and 2). Items

used an expanded response format (1 = *not at all* to 4 = *severe symptoms*; with ratings of 3 and 4 reflecting diagnostic levels). Severity ratings for each symptom were averaged, as was the case for the other scales. This measure has shown test-retest reliability (i.e., the same assessor interviewing a participant twice over a 1-2 week period) (κ = .63-1.00), inter-rater reliability (i.e., two assessors interviewing the same participant) for depression diagnosis (κ = .73-1.00), internal consistency (α = .68-.84), and predictive validity (Nolen-Hoeksema, Stice, Wade, & Bohon, 2007; Stice, Rohde, Seeley, & Gau, 2010). In trial 1 inter-rater reliability was κ = .83 for depression diagnoses and test-retest reliability was κ = .83. In trial 2 inter-rater reliability was κ = .98 at the item level and κ = 1.00 for depression diagnosis. Trial 2 showed test-retest reliability (κ = .99) and inter-item correlation for the continuous depressive symptom composite (ICC = .99). The present study showed inter-rater reliability for depression diagnoses (κ = .93) and inter-item correlation for the continuous depressive symptoms composite (ICC = .92). Assessors, blind to condition, had at least a BA in psychology, received 40 hours of training in semistructured interviews, and demonstrated high inter-rater agreement ($\kappa \geq 0.80$) with expert raters using training interviews and interview role-plays. They also had to demonstrate inter-rater κ values ≥ 0.80 for a randomly selected 10% of taped interviews throughout the study.

Substance use. Substance use was assessed with 10 items (Stice, Barrera, & Chassin, 1998). Participants indicated the frequency of intake of beer/wine/wine coolers/hard liquor over the past 30 days; their frequency of heavy drinking (five or more drinks in a row); frequency of times drunk; and frequency of use of marijuana, stimulants, downers, inhalants, and hallucinogens using a 6-point response scale ranging from 0 (*never*) to 5 (*3 to 7 times a week*). This scale has shown internal consistency (α = .79), 1-year test-retest reliability (r = .72), and predictive validity (Stice, Rohde, Seeley, et al., 2010; α = .79 at baseline).

Motivation to reduce depression. Motivation to reduce depression was assessed with a 4-item scale (e.g. "I have been struggling with the feeling of depression for a long time and am really ready to tackle this problem now") using a 5-point response format developed by our workgroup (Gau et al., 2012). It has shown internal consistency (α = .93) and 1-week test-retest reliability of r = .83 (Gau et al., 2012; α = .88 at baseline).

Negative attributional style. A short version of the Adolescent Cognitive Style Questionnaire (ACSQ; Hankin & Abramson, 2002) assessed negative attributional style.

For 12 hypothetical negative events, participants rated (a) the degree to which the cause of the negative event is internal, stable, and global, (b) the likelihood that further negative consequences will result from the negative event, and (c) the degree to which the negative event signifies that the person is fundamentally flawed. This 36-item scale has shown internal consistency (α = .82), 1-week test-retest reliability (r = .89), and correlates with BDI scores (r = .36; Stice, Rohde, Seeley, et al., 2010; α = .85 at baseline).

Perceived parental/peer support. Perceived peer and parental support was assessed using 12 items from the Network of Relationships Inventory (Furman & Buhrmester, 1985) assessing aspects of relationships (e.g., companionship, guidance, affection) between the adolescent and his/her peers and parents. This scale has shown internal consistency (α = .88), test-retest reliability (r = .69), and predictive validity (Burton, Stice, & Seeley, 2004; α = .89 and .88, for the parental and peer support scales at baseline).

Negative life events. Participants reported the occurrence of 14 negative life events during the past year (Lewinsohn et al., 1994). This scale has shown 1-week test-retest reliability (r = .90; Brière, Rohde, Shaw, & Stice, 2014) and predictive validity (Monroe, Rohde, Seeley, & Lewinsohn, 1999).

Preliminary Analysis and Statistical Methods

Distributions of the outcomes were examined for excessive violations of normality. Participants in the three conditions did not differ on demographics or outcomes at pretest. Rates of missing data for hypothesized moderators were 1-5%. Attrition for diagnostic data was 4% at posttest, 11% at 6-month, 11% at 1-year, and 15% at 2-year follow-up. Attrition did not differ between conditions (p-values > .20) or between Studies 1 and 2. On average participants completed 5.1 of 6 assessments (SD = 1.1). Attrition was not associated with any study variables except substance use (t[604] = 2.93, p = .009); those who completed all assessments had lower baseline substance use than those who did not. Thirty-five percent of participants reported receiving mental health treatment during the 2-year follow-ups; rates did not differ by condition or between Studies 1 and 2. Of those receiving treatment, 62% received individual therapy, 8% group or family therapy, 20% took medication, and 33% a combination of treatment types. Treatment type during the follow-up did not significantly differ by condition.

Changes in depressive symptoms were evaluated with random effects growth models and fit with SAS PROC MIXED. Change in symptoms from posttest to 2-year

follow-up was the outcome with pretest depressive symptoms a covariate. The data is considered partially nested because group CB was administered in a group setting and CB bibliotherapy and brochure control was not. Therefore, data were nested within group and CB bibliotherapy and brochure control participants were each treated as their own group (Bauer, Sterba, & Hallfors, 2008). When constructing the longitudinal portion of the model we (a) examined empirical growth plots; (b) evaluated an unconditional means model; (c) fit an unconditional linear growth model; and (d) fit an unconditional linear plus quadratic growth model. Various longitudinal change models were compared using the Bayesian Information Criterion and the linear plus quadratic growth model showed superior fit. We conducted three planned contrasts: CB group (coded 1) versus controls (coded 0); CB bibliotherapy (coded 1) versus controls (coded 0); and CB group (coded 1) versus CB bibliotherapy (coded 0). We used multiple-imputation to replace missing values (Graham, 2009) using the IVEWare program. Missing data points were replaced with imputed data in 10 data sets, which were analyzed separately. Model parameters and standard errors were combined following Rubin (1987) as implemented in SAS PROC MIANALYZE. Effect sizes were estimated as d-statistics using pooled raw standard deviations and model parameters involving the condition effects with formulas provided by Feingold (2009, 2013). MDD incidence was examined using discrete-time hazard models. As hazard models were designed to accommodate right censoring, we did not impute missing MDD incidence data; however, we did use multiple imputed data for missing moderators. The model specified onset of MDD in months and fit with SAS PROC PROBIT (SAS Institute Inc., 2011) using a logit link function. We conducted three planned group contrasts described above.

The intercorrelations between hypothesized moderators are shown in Table 1. The average correlation among moderators was $r = .13$ (range = $.01 - .35$). Each moderator was tested in separate moderation models. For depressive symptom growth models the moderator main effect, and their interaction terms with condition, and linear and quadratic time scores were added. A significant condition by moderator interaction term would indicate the level of the moderator impacted the effect of the intervention from pretest to the posttest assessment; a significant condition by moderator by time (linear and quadratic) interaction would indicate the moderator impacted the magnitude of the effect of condition on change in the outcome from posttest to 2-year follow-up. For MDD incidence data the moderator main effect and interaction with condition were added to the

discrete-time hazard models. A significant condition by moderator interaction term would indicate the moderator impacted the effect of condition on the risk of MDD onset. Significant interactions were probed by computing sample estimated intercepts and slope trajectories at conditional levels of the moderator for growth models and by comparing estimated probabilities at conditional levels of the moderator for hazard models. We selected values at one standard deviation (SD) below the mean-centered moderator, at the mean, and at one *SD* above the mean to represent low, moderate, and high levels of baseline moderator, respectively, following Aiken and West (1991).

Table 1

Correlation Matrix for Pretest Hypothesized Moderators

		1	2	3	4	5	6	7	8
1	MDD symptom score	1.0							
2	Motivation to reduce depression	.31	1.0						
3	Attributional style	.35	.31	1.0					
4	Substance use	.15	-.01	.17	1.0				
5	Major life events	.13	.12	.15	.26	1.0			
6	Social support	-.29	-.11	-.29	-.11	-.17	1.0		
7	Sex	.12	.07	.03	.03	.01	.01	1.0	
8	Age	.07	.08	.13	.14	-.03	-.05	-.01	1.0

Prior to evaluating the impact of the hypothesized moderators on intervention effects we examined the potential influence of study (i.e., efficacy trial data versus effectiveness trial data) as a moderator of condition effects. Study did not moderate any effects involving condition for the depressive symptoms growth model, however, for the MDD incidence discrete-time hazard models significant condition by study interactions were found for the CB group versus CB bibliotherapy (estimate = 1.79, p = .017) and CB bibliotherapy versus control (estimate = -1.90, p = .008) comparisons. To control for the influence of study its main effect and interaction with condition were added to the discrete-time hazard models for comparisons involving CB bibliotherapy.

Results

Intervention Effects for Change in Depressive Symptoms

Table 2 shows the group means for depressive symptoms across assessments. Figure 1 presents the model-implied trajectories for depressive symptom change over follow-up. Comparing CB group to brochure control, condition had two significant effects. First, the condition effect (estimate = -.150; $p < .001$, $d = .36$, a moderately small effect) indicated that, compared to controls, CB group participants had lower depressive symptom scores at posttest. Second, the condition x time effect (estimate = .014, $p = .015$, $d = .14$, a small effect) was positive, indicating that the linear decrease for controls was more steep than for CB group participants, suggesting that controls began to catch up with CB group participants over follow-up. In the symptom contrasts comparing CB group versus CB bibliotherapy, CB group participants had significantly lower depressive symptom scores at the posttest assessment (estimate = -.081, $p = .035$, $d = .20$), reflecting a small effect. No other condition effects were significant.

Table 2

Mean and Standard Deviations for Depressive Symptoms

Outcome measures	CB Group (*n* = 215)			CB Bibliotherapy (*n* = 208)			Brochure Control (*n* = 208)		
	Mean	*SD*	*%* *MDD*	*Mean*	*SD*	*%* *MDD*	*Mean*	*SD*	*%* *MDD*
Depr. symptoms									
Pretest	1.58	0.43	0.0	1.54	0.39	0.0	1.55	0.40	0.0
Posttest	1.45	0.33	0.5	1.54	0.40	2.9	1.58	0.40	4.8
6-mo follow-up	1.36	0.39	2.8	1.33	0.36	4.8	1.45	0.43	8.7
12-mo follow-up	1.39	0.39	7.4	1.41	0.44	10.6	1.42	0.43	12.0
18-mo follow-up	1.35	0.33	8.4	1.39	0.41	13.5	1.38	0.34	14.4
24-mo follow-up	1.41	0.39	10.7	1.44	0.45	16.8	1.45	0.43	17.3

Note. Means and standard deviations averaged across ten imputed data sets. Cumulative percent of cases that met criteria for major depressive disorder (MDD) from pretest through the 24-month follow-up period.
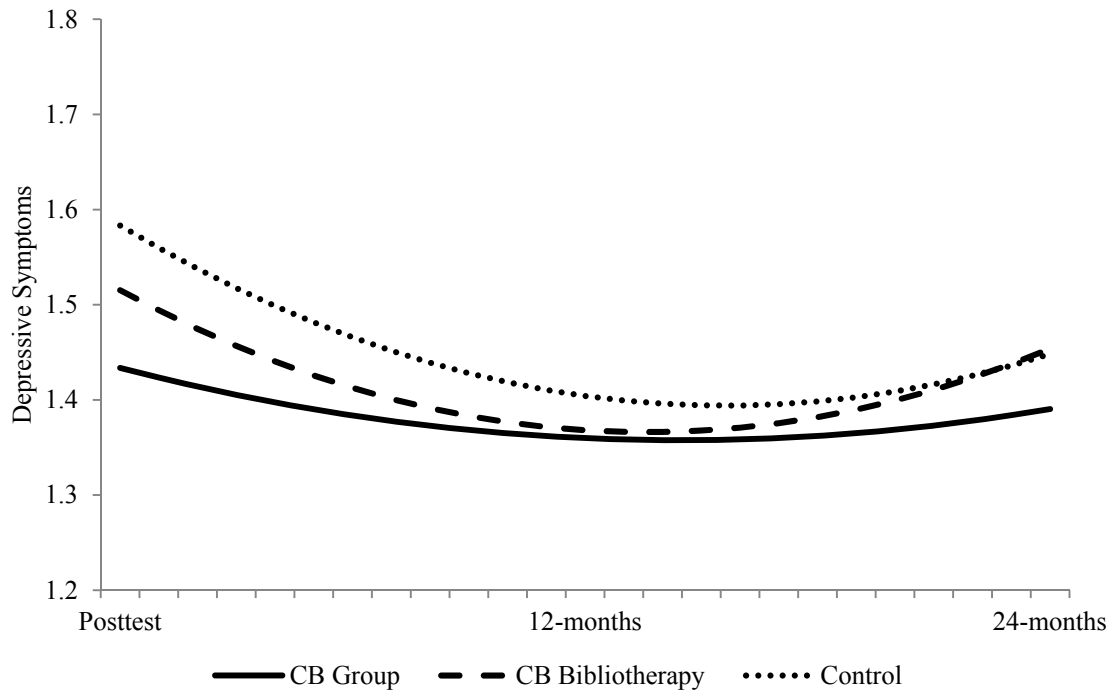
Figure 1. Model implied depressive symptom severity trajectories for the three study groups.

Moderation of Intervention Effects in Depressive Symptoms

Two significant 2-way moderation interactions were found for the CB group versus control comparison; pretest depressive symptoms amplified the effects of condition at posttest (t [240] = 2.36, p = .018), as did baseline motivation to reduce depression (t [240] = 2.17, p = .030). Simple intercept analyses showed CB group participants had significantly lower posttest depressive symptoms for participants with high (adjusted posttest symptom level for CB group and brochure control = 1.56 and 1.77, respectively; t [240] = -4.60, p < .001, d = .50) and moderate (adjusted posttest symptom level for CB group and brochure control = 1.42 and 1.56, respectively; t [240] = -4.10, p < .001, d = .35) pretest depressive symptom levels versus controls, but for participants with low baseline symptom levels (adjusted posttest symptom level for CB group and brochure control = 1.29 and 1.35, respectively; t [240] = -1.38, p = .169, d = .15) the two conditions did not differ at posttest. Similarly, CB group participants had significantly lower posttest depressive symptoms for participants with high (adjusted posttest symptom level for CB group and brochure control = 1.65 and 1.45, respectively; t [240] = -4.58, p < .001, d = .48) and moderate (adjusted posttest symptom level for CB group and brochure control = 1.56 and 1.42, respectively; t [240] = -4.11, p < .001, d = .34) pretest levels of motivation

to reduce depression versus controls, but not for participants with low motivation levels (adjusted posttest symptom level for CB group and brochure control = 1.40 and 1.47, respectively; t [240] = -1.53, p = .127, d = .17).

One 2-way interaction and one 3-way interaction emerged for the CB bibliotherapy versus control comparison; pretest depressive symptoms amplified the effects of condition at posttest (t [412] = 3.62, p < .001) and the effects of condition x linear change (t [1656] = -2.30, p = .021). Simple intercept analyses showed CB bibliotherapy participants had significantly lower posttest depressive symptoms versus controls for participants with high (adjusted posttest symptom level for CB bibliotherapy and brochure control = 1.60 and 1.81, respectively; t [412] = -3.96, p < .001, d = .45) and moderate (adjusted posttest symptom level for CB bibliotherapy and brochure control = 1.51 and 1.59, respectively; t [412] = -2.06, p = .039, d = .18) pretest depressive symptom levels, but for participants with low pretest symptom levels CB bibliotherapy participants had significantly *higher* scores at posttest (adjusted posttest symptom level for CB bibliotherapy and brochure control = 1.43 and 1.36, respectively; t [412] = 2.58, p = .010, d = .13) compared to controls. Graphs of simple slopes (Figure 2) show that CB bibliotherapy participants had similar linear change in depressive symptoms over follow-up compared to control participants at low and moderate levels of pretest depressive symptoms, but at high levels controls showed steeper linear decline in depressive symptoms over follow-up than CB bibliotherapy participants. No significant moderating effects were detected for the CB group versus CB bibliotherapy comparison.
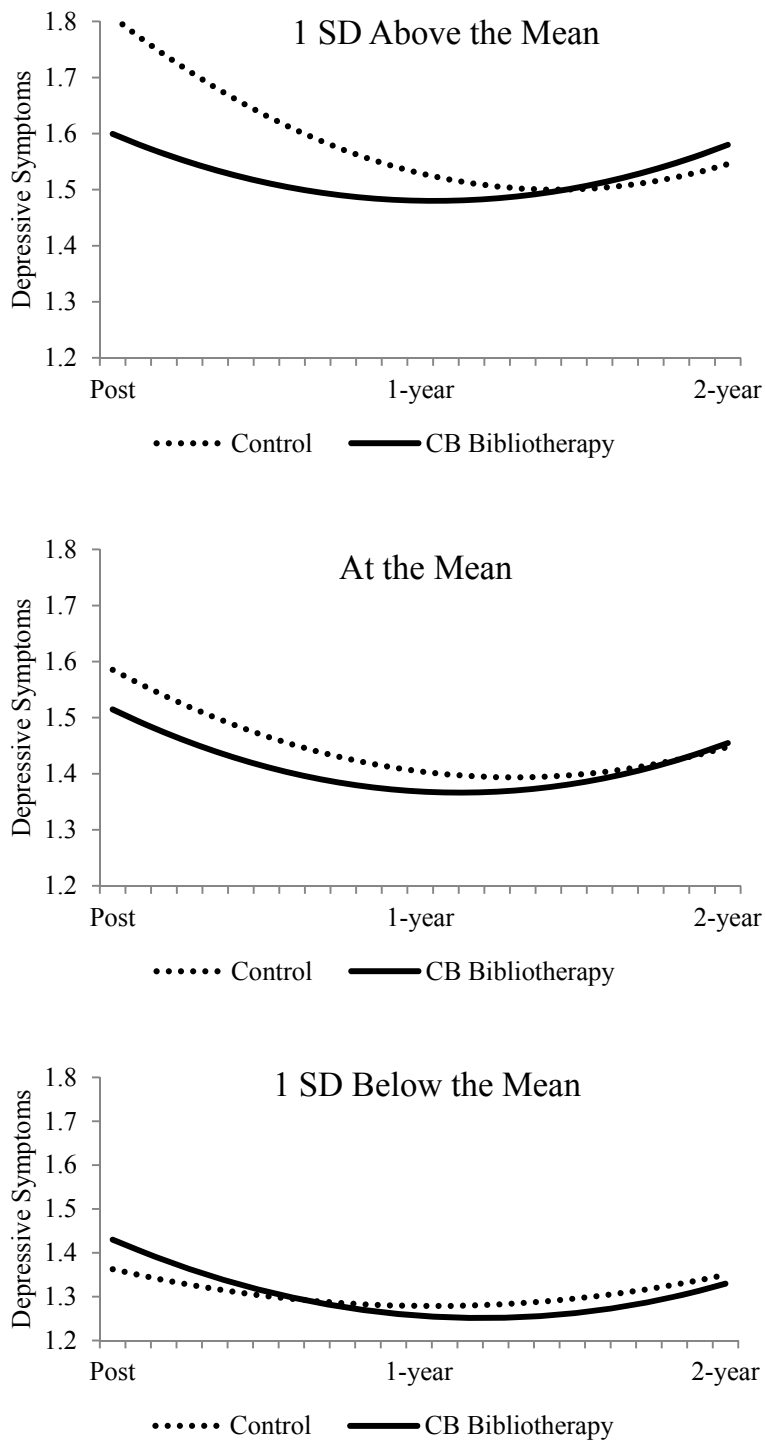
Figure 2. Simple slopes at low, medium, and high levels of pretest depressive symptoms for CB bibliotherapy versus brochure controls.

Intervention Effects for Major Depressive Disorder Onset

By 2-year follow-up, 84 participants (13%) showed MDD onset: 31 controls (15%), 31 CB bibliotherapy participants (15%), and 22 CB group participants (10%). Each condition contrast was entered separately as a predictor in the discrete-time hazard model to determine whether the risk of MDD onset during the course of the study (i.e., logit hazard function) differed by condition. No statistically significant group differences for MDD onset at 2-year follow-up were detected for the merged sample.

Moderation of Intervention Effects in Major Depressive Disorder Onset

One significant moderator x group effect was found: pretest substance use (which did not significantly differ by gender) moderated the logit hazard function for the CB group versus control contrast (odds = 2.95, p= .035), a medium-to-large effect. Logit parameters from the models were used to compute estimated probabilities of developing MDD for prototypical cases with comparisons made to a reference group (Figure 3). For the CB group versus brochure control comparison, the effect of CB group was weaker at high substance use levels, with CB group participants having an 18% *higher* likelihood of developing MDD than controls. Conversely, at low substance use levels the preventive effect of CB group was much stronger, with CB group participants having a 34% *lower* likelihood of developing MDD than controls.
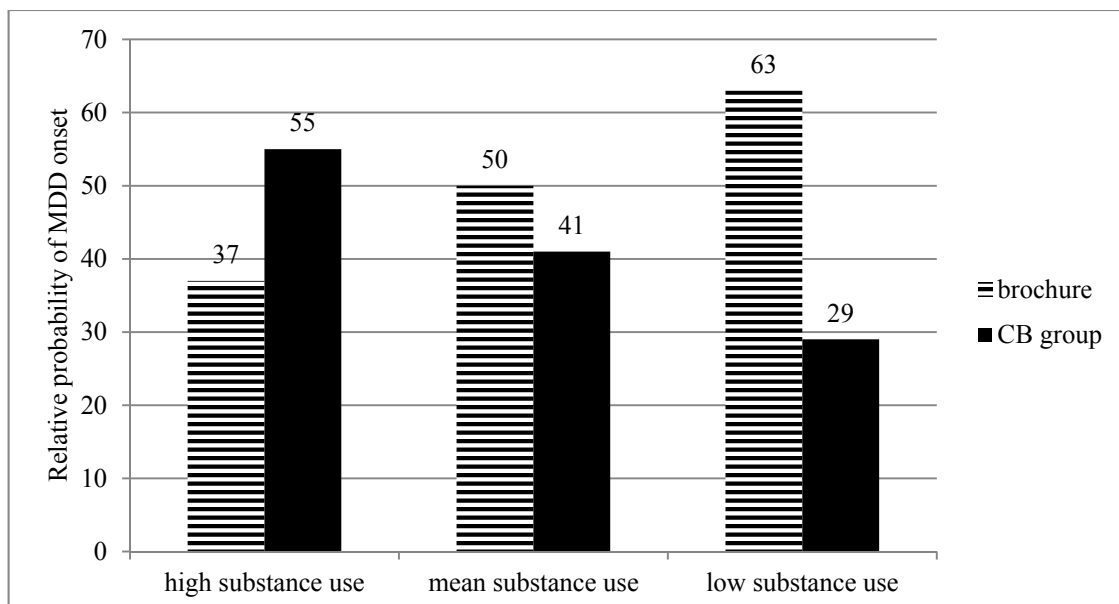

Figure 3. Interpretation of significant interaction terms (relative probability of MDD onset over 2-year follow-up). Brochure controls with mean substance use formed the reference group (50% probability) for the CB group vs. brochure controls contrast.

Discussion

Moderation of Intervention Effects in Depressive Symptom Reductions

Those receiving CB group had significantly lower depressive symptoms at posttest compared to both brochure controls ($d = .52$) and CB bibliotherapy participants ($d = .27$), reflecting a medium and small effect, respectively; symptom differences between CB bibliotherapy participants and brochure controls were nonsignificant at post and follow-up. Results also indicated that CB bibliotherapy participants and brochure controls caught up with CB group participants over time, consistent with both a regression to the mean effect and the natural remission of depression for most individuals, given time (data from representative samples of adolescents using this version of the depression interview are not available, so we do not know whether symptom levels were normalized or remain somewhat elevated). Our finding is in line with previous research by our group and others (e.g., Horowitz & Garber, 2006) that has shown that preventive effects of depressive symptoms tend to be strongest at posttest and often diminish over time. An implication of this finding could be that we do need to look at additional components that might enhance or prolong more long-term effects, for instance by introducing booster sessions.

Pretest depressive symptom levels amplified the effects of the CB group program on depressive symptom reductions versus brochure controls. CB group was superior to brochure control when adolescents entered the study with moderate or high baseline depressive symptoms but not low levels (the mean symptom level roughly corresponded to two full threshold MDD symptoms or four symptoms at subthreshold levels); the evaluated CB group was not beneficial for adolescents who are currently experiencing fewer depressive symptoms. Results converge with our hypothesis and align with evidence from past trials and meta-analyses that showed stronger effects for participants with higher versus lower initial symptoms (e.g., Jaycox et al., 1994, Horowitz & Garber, 2006; Stice et al., 2009). There are several potential explanations for this moderation effect, including the CB group being more appropriate for these youth because they have more opportunities to apply the CB skills to current negative cognitions and (consistent with the second moderation effect) a higher degree of clinical distress leading to increased motivation or readiness to change (e.g., the two variables were correlated $r = .31$ in the present study). Further, a statistical explanation for the emergence of this effect is that those with low initial symptoms may have less room for reductions than those with high

initial symptoms.

Pretest depressive symptoms also showed a slightly stronger moderating effect of CB bibliotherapy versus brochure controls. Results suggest that CB bibliotherapy requires a minimum level of depressive symptoms (approximately two full threshold symptoms or four symptoms at subthreshold levels) for effectiveness. Fortunately, Figure 2 suggests that the course of depressive symptoms over follow-up for CB bibliotherapy and controls were nearly identical, implying that there were no long-term iatrogenic effects for CB bibliotherapy among the subset of participants with low depressive symptoms.

Elevated initial motivation to reduce depression likewise amplified the effects of the CB group program on depressive symptom reductions compared to brochure controls. This moderation effect is consistent with evidence that motivation to reduce symptoms predicted the response of patients to CB treatment (Keijsers et al., 1999) but is, to our knowledge, novel in the area of depression prevention. The fact that this moderating effect was not significant in the individual trials (Brière et al., 2014; Gau et al., 2012) highlights the value of merging data sets using identical measures to increase sensitivity to detect moderating effects, which can be small. Though more studies are needed to explore whether this moderation finding replicates, this result suggests that increasing participants' motivation for engagement and change, for example by including motivational interviewing into the initial CB prevention program sessions, might be an appropriate way to enhance participants' benefit from the program. As the current sample was combined from one efficacy and one effectiveness trial, it is important to note that study did not moderate any condition effects for the depressive symptoms growth model. This indicates that the findings on moderators reported herein are alike irrespective of whether a research clinician (trial 1) or a school counselor or nurse (trial 2) delivered the program.

No significant moderating effects were found over follow-up, and although CB group produced lower posttest depressive symptoms than CB bibliotherapy, none of the examined variables moderated the effects of CB group versus bibliotherapy on depressive symptom reductions. The two conditions differed on delivery modality but shared a CB content, and the lack of moderators implies that the examined variables had a similar impact on the effects of both CB-based approaches. The fact that both CB group and bibliotherapy were superior to brochure control at higher pretest depressive symptom

levels suggests that the moderator of symptom severity may be more general rather than intervention specific. It seems intuitive that some youth would benefit from a group intervention whereas others would do best with an unassisted self-help book but we did not identify such moderators, if differences truly exist. Given the increased availability of unassisted internet-based programs for depression treatment and prevention (e.g., Van Voorhees et al., 2009), the issue of whether subgroups of at-risk adolescents do or do not benefit from self-guided programs requires more attention.

Moderation of Intervention Effects in MDD Onset

Unlike our previous single-trial results, we found no long-term depressive disorder prevention effects in the merged data set. This appears to be due to the differential disorder prevention effects for CB bibliotherapy (and to a lesser extent CB group) in the two trials. In the efficacy trial, CB bibliotherapy had a very low onset incidence of MDD and minor depression (3%) with both CB bibliotherapy and CB group (14%) having significantly lower rates of depression onset than brochure controls (23%). In the effectiveness trial, MDD onset by 2-year follow-up was significantly lower in CB group (10%) than CB bibliotherapy (25%) but did not significantly differ from brochure controls (17%). Merging data resulted in a 10% MDD incidence for CB group, which was not statistically superior to either CB bibliotherapy or brochure controls, which both had a 15% MDD incidence. Potentially, this nonsignificant effect for MDD onset occurred because of merging data from a tightly controlled efficacy trial and an effectiveness trial in which recruitment procedures were streamlined and high school counselors and nurses conducted the CB groups. As we noted (Rohde et al., in press), the lack of a significant MDD prevention effect for CB group versus brochure control implies that CB prevention may not be ready for dissemination for delivery by high school personnel.

A novel contribution of the present report is the findings on substance use as a moderator of MDD onset. For youth with low substance use, strong MDD preventive effects were evident for CB group versus controls: low substance-using adolescents assigned to CB group showed the lowest MDD onset whereas the low substance-using adolescents assigned to the educational brochure control condition showed higher MDD onset. Conversely, for adolescents who entered the study with high substance use (and depressive symptoms), MDD onset was intermediate and there was no indication that CB group reduced MDD onset; in fact, the opposite pattern was noted– this was the only

instance in which CB group appeared to be potentially iatrogenic: MDD onset among adolescents with high substance use was nearly 50% higher if they were in the CB group versus receiving the brochure. A potential explanation for this finding might be that the depressive problems of youth with high substance abuse are primarily a consequence of their substance abuse, either because of impairments in functioning or a physiological response to the substances. If true, the risk of MDD onset might significantly decrease once the substance abuse is addressed. With regard to depression symptom reductions, we found no significant effect. As a frame of reference, 51% of participants reported no substance use at pretest and the mean baseline substance use score was 0.39, which would correspond to drinking one beer 1-3 times a month, whereas a high substance use score ($0.97 = 1$ SD over the M) could be obtained by consuming 2 or 3 alcohol drinks 1-2 times weekly in the past month. We had predicted that high substance use would dampen the effect of CB group on depressive symptom reductions and the degree to which CB group prevented MDD onset. Results align with prior evidence that substance abuse might be a factor that affects onset and/or maintenance of depressive symptoms and might decrease participants' motivation to actively engage in the program and apply the skills (Brook et al., 2002; Gau et al., 2012). Consistent with the present findings, previous research has suggested that some individuals with substance use problems experience deterioration in both psychiatric symptoms and substance use following their participation in substance abuse prevention or treatment programs (Moos, 2005). Even though the CB group provides a powerful context for change for the majority of individuals, adolescents with high substance use might be more prone to experiencing negative outcomes that can occur in all social settings, such as confrontation, high emotional arousal and insufficient coping strategies, as well as frustration with their inability to keep up with other participants' progress. Stagnation or deterioration of symptoms might account for the subsequent higher MDD onset rates observed in this subgroup. The current results suggest that adolescents with a confluence of elevated depression levels and substance use do not appear appropriate for a CB group focused on depression prevention and should probably receive help reducing their substance use prior to efforts aimed directly at reducing depressive symptoms.

No evidence of moderating effects emerged for the other five factors investigated in this study. This is perhaps most surprising with regard to the demographic factors sex and age that have emerged as moderators in previous meta-analyses (Horowitz & Garber,

2006; Stice et al., 2009), though replication of moderating effects can be especially difficult in prevention science (Supplee, Kelly, MacKinnon, & Barofsky, 2013). Another factor that may explain the lack of other moderating effects is the mixed nature of previous results. For instance, even though the majority of studies on sex as a moderator have shown stronger effects in females (e.g., Gillham et al., 2006; Seligman, Schulman, DeRubeis, & Hollon, 1999), there are also studies that report stronger effects in males (e.g., Clarke, Hawkins, Murphy, & Sheeber, 1993) or no moderation effect (e.g., Gillham et al., 2012). Some of the hypothesized moderators that did not produce significant effects (i.e., negative attributional style, negative life events, perceived social support from family and friends) were measured with short questionnaires and may have required more fine-grained assessment procedures to fully address the construct or detect moderation effects.

Several limitations should be considered when interpreting these findings. First, we relied on self-report data from interviews and surveys, raising the possibility of reporter bias. Second, we merged data from two trials that used slightly different approaches to recruitment and facilitation to maximize the sensitivity to detect moderation effects that can be small in magnitude. We cannot rule out the possibility that this approach introduced noise into the data. Third, CB bibliotherapy engagement in trial 1 was higher (e.g., 28% read at least half the book in trial 1 vs. 15% in trial 2). Although the book is long (over 600 pages), the general model of cognitive therapy for depression is presented to the reader in the first 50 pages. Therefore, even a limited "dose" of the CB bibliotherapy may be sufficient. The CB bibliotherapy was designed to provide an easy to administer and low-cost alternative to the CB program. Important directions for future studies are to enhance adherence to reading the book, and to assess the percentage of activities completed among individuals in the CB bibliotherapy group. Fourth, pretest substance use was associated with greater attrition over 2-year follow-up, though there was no evidence of differential attrition across conditions at 2-year follow-up for high substance use participants ($p = .67$). Fifth, we did not collect data on current parental depression, which moderated the effect of CB group in another trial (Beardslee et al., 2013; Garber et al., 2009). Sixth, though our results align with prior evidence that substance abuse might decrease participants' motivation to actively engage in interventions and apply the skills learned (Brook et al., 2002; Gau et al., 2012; Rohde et al., 2001), there was no significant correlation at baseline between substance abuse and motivation to reduce

depression in the current study. This might be due to the fact that motivation to reduce depression has different behavioral consequences than motivation to engage in a program and apply the skills taught. To disentangle the motivational context, future research is needed in which factors such as in-session engagement and effective use of the skills outside of session are investigated. Finally, the moderating effects of motivation on depressive symptoms and substance use on MDD onset are new findings and replication is necessary to increase confidence in the reliability of these effects. Nonetheless, the novel moderation effect of motivation to reduce depression is consistent with prior research on patients' response to CB treatment (Keijsers et al., 1999) and the moderation effect of substance use on MDD onset was medium in magnitude, which increase confidence in these results. Our finding that higher baseline depressive symptoms amplify the intervention effects has previously emerged in multiple trials (e.g., Jaycox et al., 1994; Spence et al., 2003; Tandon et al., 2015), thus providing greater confidence in its reliability.

Collectively, results suggest some options for enhancing the effectiveness of CB depression prevention efforts with at-risk adolescents. We replicated what has probably been the most consistent moderator effect in depression prevention literature: program effects are stronger among those individuals with higher baseline symptoms. Thus, indicated prevention efforts, rather than selective or universal approaches, may produce the greatest depressive symptom reductions. The examination of both depressive symptom levels and MDD onset as separate outcomes illustrates that prevention programs can have both acute and long-term effects that are distinguishable. Second, the present findings suggest that requiring at least a moderate degree of motivation to reduce depression for enrollment in CB depression prevention programs or beginning a prevention program with a motivational enhancement component might amplify depressive symptom reduction effects. Last, the moderation effects for MDD onset suggest that it may be prudent to exclude youth who have current elevated levels of substance use from brief CB group depression prevention programs, as data imply that they do not benefit from such programs.

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8   STUDY 3

PROCESSING OF AMBIGOUS FACIAL AFFECT IN ADOLESCENTS WITH DEPRESSIVE SYMPTOMS PRIOR TO AND FOLLOWING SOCIAL EXCLUSION: THE ROLE OF PERCEPTUAL SENSITIVITY AND RESPONSE BIAS

Abstract

Depressive symptoms in adolescents are an important mental health issue and are associated with adverse developmental outcomes. Impairments in facial affect processing are considered an important factor in the etiology of depression. However, studies on facial affect processing in youth with depressive symptoms are lacking. This study investigated alterations in facial affect processing and the underlying mechanisms (perceptual sensitivity vs. response bias) related to adolescent depression, as well as the potential impact of negative social experiences. 60 adolescents (*M* age = 13.24, *SD* = 1.03, 66.7% female) with high (HD) and low (LD) depressive symptoms rated the predominant affective expression in ambiguous stimuli with varying intensity (happy-sad, happy-angry, sad-angry), prior to and following a negative (social rejection), positive (social inclusion) or no social experience with the depicted model identities. There were no baseline differences between groups. The LD group exhibited an increased perceptual sensitivity to happy expressions depicted by benevolent and stranger models, whereas the HD exhibited a high sensitivity toward happy expressions depicted by rejecting social partners. The results suggest that depressive symptoms in adolescents may be associated with an altered processing of facial affect in partners who had previously rejected them. Implications of these findings for development and maintenance of adolescent depression are discussed.

Keywords: depression, ambiguous faces, bias, sensitivity, adolescence

Processing of Ambiguous Facial Affect in Adolescents with Depressive Symptoms Prior to and Following Social Exclusion: The Role of Perceptual Sensitivity and Response Bias

Adolescence is a crucial time period characterized by a strong focus on peer relationships during which children develop social skills that will shape the way they interact with their social partners in adulthood. Accurate recognition and identification of facial expressions is vital for normal social development, adaptive emotion regulation skills and appropriate social functioning in general (Milders, Bell, Platt, Serrano, & Runcie, 2010; Yoon, Joormann, & Gotlib, 2009) and impairments have been linked to a number of psychiatric conditions, such as depression (Jusyte & Schönenberg, 2014). In fact, distortions of facial affect processing in depressed individuals may represent one of the key factors related to the etiology of affective symptoms, problematic social interactions and behavioral tendencies such as withdrawal or feelings of rejection (Bourke, Douglas, & Porter, 2010; Suslow & Dannlowski, 2005). Thus, first manifestations of psychopathological symptoms may seriously compromise the development of social cognition and contribute to detrimental outcomes (Gollan, McCloskey, Hoxha, & Coccaro, 2010).

Adolescence is also a vulnerable period during which first manifestations of depressive symptoms may occur, with a steep increase of these symptoms and high recurrence rates during adulthood (Lewinsohn, Rohde, Klein, & Seeley, 1999; Rutter, Moffitt, & Caspi, 2006). 3-8% of youth develop depressive disorders and those affected also often experience impairments in psychosocial functioning, such as an increased risk for suicidal behavior, substance abuse, interpersonal problems, comorbid disorders, and academic failure (e.g., Klein, Torpey, & Bufferd, 2008; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2003; Newman et al., 1996). Despite many research attempts to investigate facial affect processing and its relationship to depressive symptoms, the underlying mechanisms as well as the developmental course are barely understood. Whereas the evidence is growing but inconclusive for adult samples, there is an even greater lack of research in pediatric samples suffering depressive symptoms.

Facial Affect Processing in Depression

A number of studies in adult samples have demonstrated that depression is associated with altered processing of facial expressions of emotion in different stages of information processing affecting perception, attention and memory (for a review see Bourke et al., 2010; Demenescu, Kortekaas, den Boer, & Aleman, 2010). However, studies that compared accuracy ratings for prototypical expressions in depressed adults have brought conflicting evidence, indicating difficulties in the accurate identification of both happy and sad expressions (Bouhuys, Geerts, & Gordijn, 1999; Joormann & Gotlib, 2006; Leppänen, Milders, Bell, Terriere, & Hietanen, 2004; Mikhailova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996; Surguladze et al., 2004), or no differences to healthy controls (Bourke et al., 2010; Jusyte & Schönenberg, 2014).

Cognitive theories of depression propose that alterations in emotion processing should be most prominent for ambiguous information (Beck, 1967). Thus, one possible explanation for the inconsistency across previous findings may be that depressed individuals do not exhibit a deficit in the processing of prototypical, but rather ambiguous facial expressions. Prior investigations that implemented ambiguity by using static or animated blends of neutral and emotional expressions suggest that adult depression is associated with a deficient processing of happy (Joormann & Gotlib, 2006; LeMoult, Joormann, Sherdell, Wright, & Gotlib, 2009; Yoon et al., 2009) and an enhanced recognition of sad expressions (Joormann & Gotlib, 2006). The few studies that used equivalent methodology in high-risk or depressed adolescent samples produced contrary results, indicating that high-risk individuals exhibit both deficient (Joormann, Gilbert, & Gotlib, 2010) vs. enhanced (Lopez-Duran, Kuhlman, George, & Kovacs, 2013; Schepman, Taylor, Collishaw, & Fombonne, 2012) ability to accurately identify sad facial expressions as well as the tendency to misclassify happy and sad facial expressions as angry (Jenness, Hankin, Young, & Gibb, 2015).

Ambiguity in facial expressions can also be created by using blends between *two different* emotional expressions (e.g., 40% sad and 60% angry), allowing for a more appropriate investigation of interpretative biases (Jusyte & Schönenberg, 2014; Wilkowski & Robinson, 2012). The few prior studies on depressed or dysphoric adult samples using truly ambiguous stimulus material suggest a bias toward a negative interpretation (Bouhuys et al., 1999; Liu, Huang, Wang, Gong, & Chan, 2012; Schönenberg et al., 2014; Schönenberg & Jusyte, 2014). To the best of our knowledge,

only one study to date has investigated emotion discrimination in a pediatric sample using truly ambiguous stimuli (Lopez-Duran et al., 2013). The authors documented that adolescents with a high risk for depression as well as the control group exhibited an over-identification of sadness in ambiguous faces, with a lower tendency for participants in the high-risk group. In summary, research evidence on facial affect processing in depression is not clear-cut, widely depending on the stimulus material, study population and the paradigmatic approach.

Influence of State Components

The inconsistent findings across previous studies may also be explained by cognitive reactivity, a concept which suggests that depression-related processing patterns may only emerge when depressive schema are activated (Gotlib & Hammen, 1992; Schönenberg et al., 2014). Support for this assumption is provided by studies which demonstrated depression-related processing alterations only following mood induction (Geerts & Bouhuys, 1998; Joormann et al., 2010; Joormann, Talbot, & Gotlib, 2007; Lopez-Duran et al., 2013; Schönenberg & Jusyte, 2014).

However, it is unclear whether the commonly used mood inductions using film or lexical material capture the nature of depression-inducing real-world experiences, such as negative interactions or social rejection. Taking a step toward a more naturalistic scenario is crucial for the understanding of alterations in social signal processing that occur in the instance of social interactions. Social rejection is a universal and depressogenic experience which causes a tension between reestablishing social acceptance (Maner, DeWall, Baumeister, & Schaller, 2007; Pickett & Gardner, 2005) and the attempt to avoid further aversive experiences (Maner et al., 2007). Accordingly, experimentally induced social rejection has been shown to exert conflicting effects on subsequent social information processing, with some studies indicating a preference for prosocial signals, i.e., smiling faces (Bernstein, Young, Brown, Sacco, & Claypool, 2008; DeWall, Maner, & Rouby, 2009), but also signals of threat, such as angry or disgusted faces (Beevers, Wells, Ellis, & Fischer, 2009; Radloff, 1977). It is possible that individual differences, such as increased levels of depression, may modulate these different reaction patterns to experiences of social exclusion, fostering the emergence of cognitive biases and subsequent depressotypic behaviors. The reagibility to the effects of peer exclusion may be especially pronounced during adolescence, where the peer group is of crucial

importance and social exclusion has been shown to have a strong relationship with depression (Coyne, 1976; Gazelle & Ladd, 2003; Lefkowitz & Tesiny, 1984). Surprisingly, no study to date has investigated whether and how social exclusion could impact facial emotion processing in depressed vs. non-depressed individuals.

Underlying Mechanisms: Perceptual Sensitivity vs. Response Bias

Despite previous research attempts to investigate facial affect recognition in major depression, the underlying cognitive mechanisms are barely understood. Both psychopathology-related changes in perceptual sensitivity as well as an interpretation bias may be at the root of the observed alterations (Wilkowski & Robinson, 2012). For instance, a depressed individual may label ambiguous expressions as sad due to an increased perceptual sensitivity to sad expressions, but it may just as likely be the case that depressed individuals do so because they tend to label ambiguous stimuli as sad, regardless of the actual emotional expression displayed. The discrimination between interpretation bias and perceptual sensitivity is possible with more sophisticated analysis methods derived from signal detection theory (SDT), namely *d-prime*, which is an index of perceptual sensitivity and *beta,* commonly used as a measure of bias (Macmillan & Creelman, 2005). Unfortunately, no study to date has attempted to delineate the mechanisms underlying depression-related alterations in facial affect processing.

Aims and Hypotheses

In the present study we investigated two major issues in an adolescent sample with high vs. low depressive symptoms (HD vs. LD): First, we aimed to examine potential preexisting alterations of ambiguous facial affect processing in adolescent depression, as well as the impact of immediate negative social experiences on potential processing alterations. For this purpose, we created ambiguous stimuli using blends (40%, 50%, 60% and full-blown emotion) of angry, sad and happy facial expressions depicted by adolescent models. To induce this social experience, we employed the so-called *Cyberball paradigm*, a virtual ball-tossing game in which participants are included or excluded (Williams, Cheung, & Choi, 2000). Due to its ecological validity this paradigm is the most frequently used in the literature on social exclusion (Williams, 2007).

Based on previous findings indicating altered processing of both happy and sad emotional expressions, we expected the HD group to exhibit an enhanced processing for sad as well as possible attenuation for happy expressions at baseline. In accordance with

assumptions of cognitive reactivity, we expected these potential alterations at baseline to be more pronounced following a social rejection experience. The second aim of the current study was to elucidate the mechanisms underlying these potential alterations: we were interested whether exclusion experiences are driven by perceptual processes or an interpretation bias. This knowledge is of high importance because it may have important implications for the understanding of the development and maintenance of depressive symptoms in general, as well as for the development of novel prevention and intervention strategies.

Materials and Methods

Participants

The sample for this study consisted of 60 individuals (*M* age = 13.24, *SD* = 1.03, 66.7% female) between 11 and 15 years of age. Participants were students recruited from local public vocational schools and through advertisements at the Outpatient Clinic of the University of Tübingen, using direct mailings inviting them to participate in the study. Written informed consent was obtained from participants and their legal guardians prior to data collection. Exclusion criteria were: reported current psychopathology other than depressive symptoms or a history thereof, or current psychopharmacological treatment. All participants received monetary compensation for completing assessments. The study was approved by the local ethics committee and was conducted in accordance with the Declaration of Helsinki.

Procedure

Student participants were tested at the institute's laboratory and in designated rooms of the public schools after school hours. All assessments were carried out by trained members of our work group.

The experiment consisted of two assessments (Figure 1A). Prior to the first assessment, participants were asked to complete several self-report measures. The severity of depressive symptoms was assessed with the Beck Depression Inventory II (Becks Depressionsinventar, BDI-II (Hautzinger, Keller, & Kühner, 2010)). Subsequently, participants performed the emotion recognition task (ERT), in which they were instructed to indicate the dominant emotion in ambiguous facial expressions. The second assessment was scheduled around one week later and began with mood and model

identity ratings for manipulation check purposes. Participants then played two versions (inclusion, exclusion) of the Cyberball-game with subsequent mood and model ratings and ERT. Finally, one last assessment of mood and model ratings was administered before debriefing and dismissing the participants.

Emotion Recognition Task

Stimuli. Digitalized photographs of angry, happy and sad expressions (six adolescent models - three male (#39, 42, 63), three female (#11, 44, 65)) were selected from the Radboud Faces Database (Langner et al., 2010), adjusted for luminance and color (Adobe Photoshop CS4) and subsequently blended into each other (FantaMorph software, Abrosoft, Beijing, China) to create three affective dimensions (happy-angry, happy-sad, sad-angry) with 100%, 60%, 50%, 40%, and 0% intensities (Figure 1D). The inclusion of 100% emotion intensity allowed for the identification of response patterns indicative of inattention. The stimulus material for the experiment consisted of 90 distinct images (6 models x 3 emotional dimensions x 5 ambiguity levels). A different set of 15 stimuli (1 model x 3 emotional dimensions x 5 ambiguity levels) was created for the practice trials.

Design. At both assessments, the ERT was preceded by 15 practice trials. The first assessment consisted of a total of 180 trials (6 models x 3 emotional dimensions x 5 ambiguity levels x 2 repetitions), and 540 trials were administered in assessment two (2 models x 3 conditions (includer, excluder, stranger) x 3 emotional dimensions x 5 ambiguity levels x 6 repetitions). Trials were pseudo-randomized across emotions and model identities (i.e., no more than two consecutive trials in a row). Includer, excluder and stranger model identities were randomized across the participants in order to avoid model effects. The temporal trial structure was as follows (Figure 1B): at the beginning of each trial, a fixation cross was presented for 500ms and replaced by a face stimulus (1000ms). Subsequently, participants were asked to indicate the predominant affective expression (happy, angry, sad) via a button-press.

Manipulation Check

The model identities were rated regarding fairness and sympathy on a scale from 1 (indicating unfair/unpleasant) to 10 (fair/pleasant) on several separate occasions. Current mood was assessed with a four-item questionnaire (good/bad, happy/sad,

relaxed/tense, and friendly/unfriendly mood) on a scale from 1 to 9, with lower scores indicative of a worse mood.

Cyberball-game

Prior to the second ERT assessment, participants were asked to play the Cyberball-game (Williams et al., 2000) with two other players (neutral facial expression) that were displayed on the screen, and instructed to visualize the situation as vividly as possible (Figure 1C). The players depicted were two of the six models that were randomly chosen for each condition and participant. Prior to the game, participants were instructed to catch the virtual ball when it was thrown toward them and to subsequently toss it to another player. In the inclusion condition, the participant received the ball exactly one third of the time from the co-players (*includers*). In the second part, the participant received the ball 2-3 times in the beginning of the game but was subsequently ignored by the other players (*excluders*). Two remaining models were not associated with inclusion or exclusion and are therefore referred to as *strangers*.
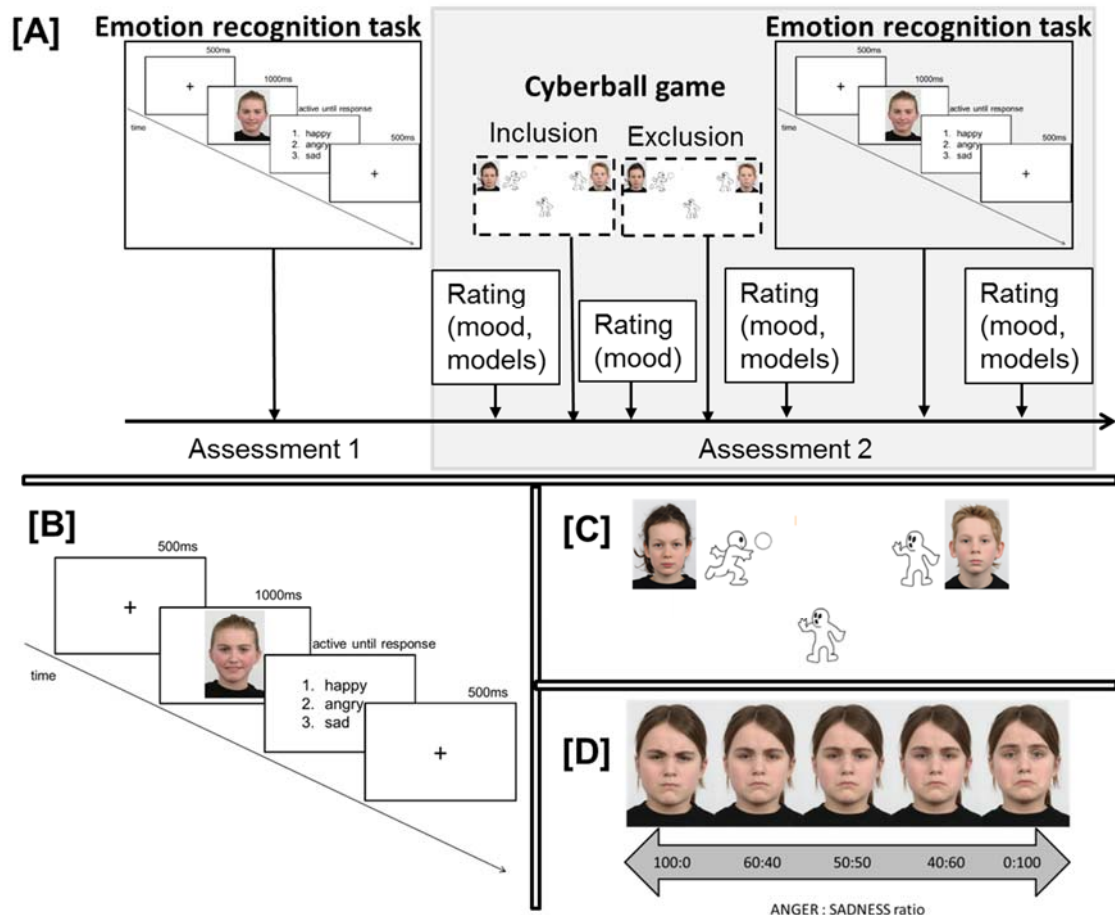
Figure 1. A) Outline of the sequence of the experimental procedure. B) Temporal trial structure in the emotion recognition task. C) Illustration of the Cyberball-game. D) Example of the stimulus material used in the emotion recognition task

Results

Participants

A total of 69 adolescents participated in the study. Three subjects were excluded due to self-reported current diagnosis and associated pharmacological treatment of ADHD. None of the remaining individuals reported current psychopathology, other chronic diseases, or any current psychopharmacological treatment. Six participants were excluded from further data analysis due to performance indicative of inattention/lack of understanding of the task (hit rates < 60% at unambiguous intensity levels). Hence, the final sample consisted of 60 individuals. The final sample was divided into HD ($N = 26$) and LD ($N = 34$) subgroups according to a cut-off criterion of a sumscore ≥ 13, indicative of mild depressive symptoms (Harmer et al., 2009). HD and LD groups did not differ in age (HD: $M = 13.42$, $SD = 1.03$; LD: $M = 13.25$, $SD = 1.05$; $t(58) = -.63$; n.s.) or gender

ratios (HD: 57.7% female; LD: 73.5% female; $\chi^2(1)$=1.66; n.s.). HD participants exhibited significantly higher depression levels as indicated by the BDI-II scores (HD: *M* = 19.19; *SD* = 6.33; LD: *M* = 7.11; *SD* =3.76; *t*(58) = -9.02; *p* < .001).

Baseline Performance

Emotion perception. To analyze participants' general ability to categorize ambiguous emotional expressions, an initial analysis was computed with the sum scores of angry, happy and sad endorsements. A 3 (emotion: angry, sad, happy) x 5 (intensity ratios: 0, 40, 50, 60, 100%) x 2 (group: HD vs. LD) analysis of variance (ANOVA) was conducted, yielding significant main effects of emotion (*F*(2, 116) = 15.52, *p* < .001, η^2=.21) and intensity (*F*(4, 232) = 1425.45, *p* < .001, η^2=.96), which were further qualified by an emotion dimension x intensity interaction (*F*(8, 464) = 28.74, *p* < .001, η^2=.33); no other effects or interactions reached significance. The intensity x emotion interaction was characterized by a stronger tendency to make "sad", compared to "angry" and "happy" endorsements at intermediate (40, 50, 60%) intensity levels (Figure 2A).

SDT analysis. Subsequent SDT analyses were conducted to investigate possible group differences in perceptual sensitivity and response bias. Respective 40% and 60% intensity blends were used to compute hit and false alarm rates for the calculation of SDT indices *d-prime* and *beta* (Macmillan & Creelman, 2005). D-prime reflects sensitivity to subtle intensity changes, with positive values indicating perceptual sensitivity (d-prime = 0 indicates no discriminatory ability), whereas β reflects a response bias, e.g., the tendency to label a stimulus as "sad" irrespective of the objective presence of sadness (β-scores = 1 signify no bias toward a "yes" or "no" response whereas values < 1 indicate a bias toward responding with a "yes").

D-prime scores were then entered into a 3 (emotion: angry, happy, sad) x 2 (group: HD vs. LD) repeated measures ANOVA (Figure 2B). A main effect of emotion (*F*(2, 116) = 64.83, *p* < .001, η^2=.53) emerged, whereas no other effects reached significance (all *p*s > .10). Post-hoc tests indicated that participants exhibited an overall increased sensitivity to happy, compared to angry and sad expressions (*p* < .001). Thus, the results did not indicate that HD and LD individuals differed in their baseline perceptual sensitivity.

An analogous analysis was computed for the β scores, yielding only one significant main effect of emotion (*F*(2, 116) = 37.37, *p* < .001, η^2=.39; Figure 2C). Post-hoc analysis showed that the main effect of emotion was characterized by a response bias

for the "sad" category, with no response bias for "angry" and "happy" categories ($ps <$ .001). These results indicate that in ambiguous sad-angry and sad-happy blends both groups tended to favor the sad response option.

Manipulation Check: Cyberball-game

The Cyberball-game induced the expected effects on the participant's mood, with an increase following inclusion and a decrease following exclusion experience. HD participants tended to exhibit overall lower mood ratings. The effects of the Cyberball-game were also evident in the subjective fairness and sympathy ratings for different model identities, with all participants providing lower ratings for excluder (vs. includer and stranger) models after the game (see Appendix).

Performance Following Exclusion

Emotion perception. A 3 (condition: excluder, includer, stranger models) x 3 (emotion: angry, sad, happy) x 5 (intensity: 0, 40, 50, 60, 100%) x 2 (group: LD vs. HD) repeated measures ANOVA was conducted to analyze the general emotion perception performance following the Cyberball-game manipulation. A main effect of emotion ($F(2, 116) = 4.84$, $p < .01$, $\eta^2 = .08$) and intensity ($F(4, 232) = 1027.81$, $p < .001$, $\eta^2 = .95$) emerged and was further qualified by an emotion x intensity ($F(8, 464) = 23.14$, $p < .001$, $\eta^2 = .29$) and an intensity x group ($F(4, 234) = 4.05$, $p < .01$, $\eta^2 = .06$) interaction. The intensity x emotion interaction was characterized by a stronger tendency to make "angry" and "sad" than "happy" endorsements at intermediate (40, 50, 60%) intensity levels (Figure 3A). The group x intensity interaction resulted from the tendency toward a slightly better categorization performance for unambiguous (0% and 100%) expressions in the HD compared to LD group (Figure 3B).

SDT analysis. Repeated-measures ANOVAs were conducted for the d-prime and β indices, which were computed for every condition and emotion category using 40% and 60% intensity levels in an analogous manner to the procedure at baseline. For the d-prime indices, the 3 (emotion) x 3 (condition) x 2 (group) repeated measures ANOVA yielded a significant main effect of emotion ($F(2, 116) = 42.41$, $p < .01$, $\eta^2 = .42$), which was further qualified by a significant emotion x condition x group interaction ($F(4, 232) = 2.55$, $p < .05$, $\eta^2 = .04$).

To further investigate the interaction effect, separate repeated-measures ANOVAs were conducted for each emotion (condition by group analyses). With respect to the

sensitivity scores for happy faces, a significant interaction emerged (F(2, 116) = 3.84, p < .05, η^2=.06), which was characterized by a higher sensitivity to happy facial expressions of includer and stranger compared to excluder models in the LD group (Figure 3C). In the HD group, there was a tendency toward a higher sensitivity to happy excluder compared to includer and stranger faces. Analogous ANOVAs conducted for sad and angry expressions did not yield any significant main effects or interactions (all ps > .05).

To investigate the response bias β, a 3 (emotion) x 3 (condition) x 2 (group) repeated-measures ANOVA was conducted, yielding only a significant main effect of emotion (F(2, 118) = 28.36, p < .001, η^2=.33), which was characterized by an overall tendency toward a "sad" response bias, compared to "angry" and "happy" response categories, with the "happy" category showing a tendency toward more "no" responses compared to "angry" (Figure 3D). No other effects or interactions reached significance.
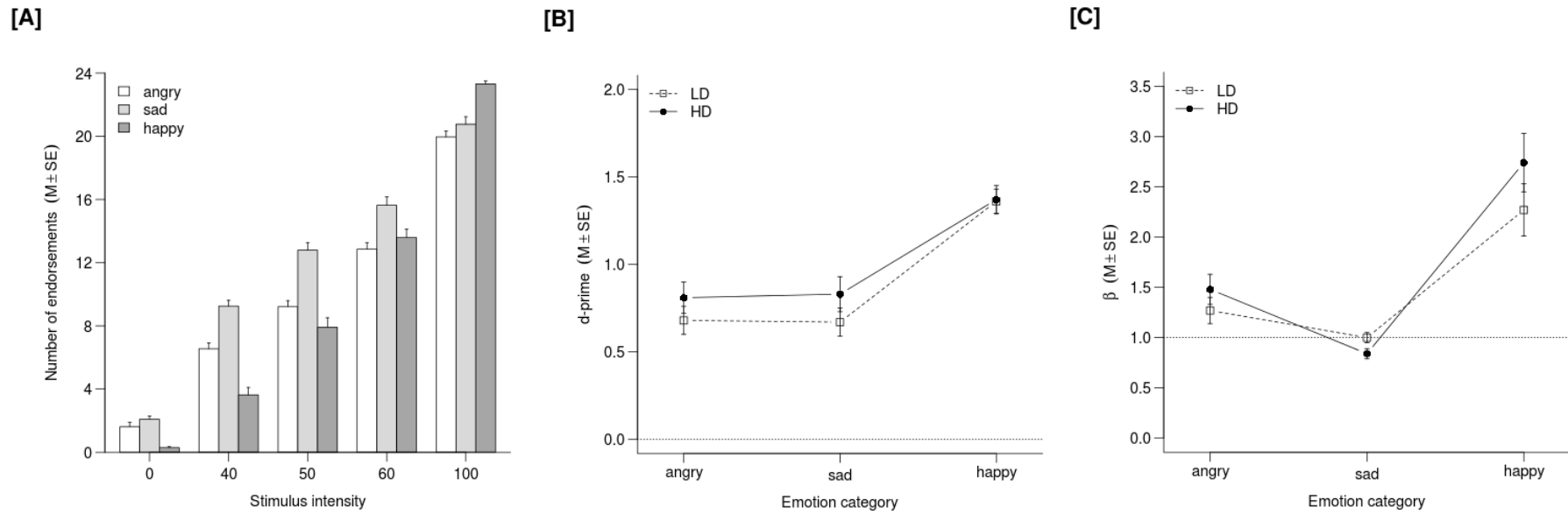
Figure 2. Baseline performance in the emotion recognition task. A) Number of endorsements for each emotion category across groups; B) d-prime-scores for each emotion category; C) β-scores for each emotion category; LD = low depressive symptoms; HD = high depressive symptoms.
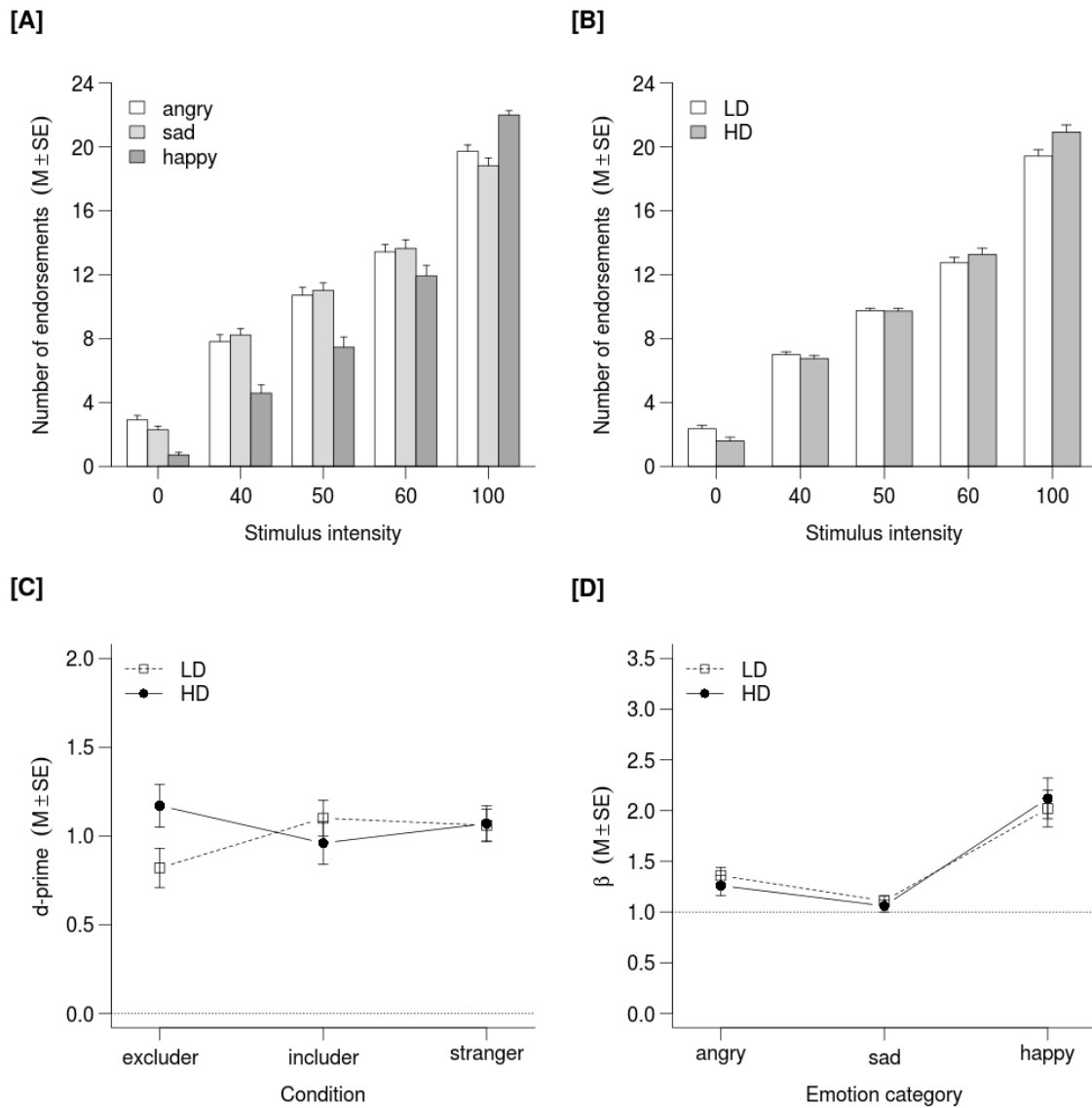
Figure 3. Performance in the emotion recognition task following Cyberball-game. A) Number of endorsements for each emotion category across groups; B) Number of endorsements for each group across emotion categories; C) d-prime-scores for happy facial expressions; D) β-scores for each emotion category. LD = low depressive symptoms; HD = high depressive symptoms.

Discussion

The aim of the present study was to investigate alterations in facial affect processing and their underlying mechanisms related to adolescent depression, as well as the impact of negative social experiences on these alterations. The main findings can be summarized as follows: there were no baseline differences with regard to general emotion categorization performance, perceptual sensitivity or response bias between HD and LD groups. Following the Cyberball-game, the LD group demonstrated an increased sensitivity for happy expressions of both includer as well as stranger models, but not excluder models. However, the result pattern for the HD group was unexpected: the participants exhibited a *higher* perceptual sensitivity (d-prime) to happy excluder vs. includer/stranger models, indicative of altered perceptual processing patterns compared to the LD individuals. There was no evidence for alterations in response bias, indicating that the observed group differences underlie perceptual shifts.

Baseline Performance

Taken together, the current findings do not indicate baseline differences in the general categorization abilities, perceptual sensitivity or response tendencies in the processing of ambiguous angry, happy and sad facial expressions. This is in accordance with research that suggests no differences in the identification and processing of full-blown emotions in dysphoric (Beevers et al., 2009; McClintock, Husain, Greer, & Cullum, 2010) or depressed populations (Gollan et al., 2010; Milders et al., 2010), but runs counter another line of literature that documented alterations in adult (e.g., Bouhuys et al., 1999; Geerts & Bouhuys, 1998; Hale III, 1998; Joormann & Gotlib, 2006; LeMoult et al., 2009; Liu et al., 2012) as well as juvenile populations (Jenness et al., 2015; Joormann et al., 2010; Lopez-Duran et al., 2013; Schepman et al., 2012). However, it is important to note that the evidence from these studies is highly heterogeneous regarding the direction of the bias as well as the specificity to certain emotional expressions. As detailed before, the reasons for the conflicting findings may be due to critical sample and methodological issues, such the use of unambiguous stimulus material vs. emotional blends. Most importantly, the present findings are in accordance with the only previous study using truly ambiguous stimuli on a high-risk pediatric sample, which did not find an enhanced identification of sadness in ambiguous facial expressions (Lopez-Duran et al., 2013) when examining both high-risk girls and boys. Though no consensus can be

achieved due to contradictory findings in previous studies, the current study extends the existing literature and supports the notion that there are no baseline differences in emotion recognition performance in HD as opposed LD youths in neither of the possible underlying mechanisms, namely response bias and perceptual sensitivity.

Emotion Perception Following Exclusion

The major finding of the current study suggests an altered facial emotion processing in HD adolescents following an experience of social exclusion. This finding supports the idea that depression-related processing patterns may only emerge when depressive schema are activated (Gotlib & Hammen, 1992; Schönenberg et al., 2014). This assumption is underscored by studies on formerly depressed patients (Geerts & Bouhuys, 1998; Schönenberg & Jusyte, 2014) and youth at risk for depression (Joormann et al., 2010; Joormann et al., 2007; Lopez-Duran et al., 2013), demonstrating that depression-related processing alterations occur only following mood induction.

In the current study we extend this previous methodology of depressive mood induction via video or lexical material, by using the Cyberball-game procedure, allowing for the modeling of positive (inclusion) and negative (exclusion) social experiences which may bear a higher similarity to real-life social interactions. This novel approach allowed for the investigation of social experiences on subsequent processing of facial affect depicted by models displaying prosocial (includers) or ostracizing (exclusion) behavior. The results show that LD participants exhibited an increased perceptual sensitivity for happy expressions of includer and stranger, but not excluder models, which is in accordance with the assumption that experiences of social exclusion activate reaffiliative behavior (Maner et al., 2007; Pickett & Gardner, 2005). For instance, social exclusion has been shown to increase the processing advantages of smiling (Beevers et al., 2009; DeWall et al., 2009; Radloff, 1977) faces and to facilitate the discrimination between real and fake smiles (Bernstein et al., 2008), indicative of an enhanced processing of benign social signals. Thus, this pattern supports the notion that exclusion experiences may encourage an adaptive orienting toward positive social cues and accepting social partners.

In contrast, the HD individuals appeared to exhibit an altered perceptual processing following social exclusion: Compared to the pattern of LD individuals, the HD group exhibited the highest perceptual sensitivity to happy faces depicted by excluder, compared to includer and stranger models. No group differences were evident

in terms of response bias, indicating that depression-related shifts following exclusion were restricted to changes in perceptual processing, rather than the unmasking of a latent response bias. This main finding was unexpected, as many previous studies point to an attenuated processing of happy and/or increased processing of sad or angry facial expressions being associated with depression.

Underlying Mechanisms

The increased sensitivity to happy faces of excluder models in the HD group may be a result of a perceived incongruity between the negative experience with these individuals and the display of prosocial expressions. For instance, one study showed that social exclusion led to a higher sensitivity for real vs. posed smiles (Bernstein et al., 2008). Furthermore, there is initial evidence suggesting that positive affect is associated with increased, and negative affect with decreased perceived genuineness of facial expressions (American Psychiatric Association, 2013). Hence, an enhanced sensitivity to happy expressions of excluder models may be indicative of an increased impression of ingenuousness in HD individuals. Furthermore, one may speculate that the enhanced perception of smiling excluders is also likely to be associated with a negative valence and can be interpreted in terms of mocking rather than reassuring and favorable social signals. However, we cannot make definitive statements about the potential mechanism underlying this effect, as we did not assess perceived valence of the ambiguous face stimuli. Future studies are needed in order to further investigate the possible mechanisms underlying these preliminary results.

Despite the preliminary nature, these findings have potential importance for the understanding of adolescent depression. Our results illustrate that these experiences not only affect the current mood, but may also distort perceptual processing of social cues that the individual may be unaware of. Future studies are needed to investigate whether therapeutic strategies such as cognitive behavioral therapy (CBT) that address these highly automated, latent depressotypic cognitive structures may also alter these latent perceptual distortions. Furthermore, assessing peer group status may prove very important when dealing with pediatric depression, due to intimate connections between social withdrawal/exclusion and depression. Thus, development of strategies that focus on implementing changes in the peer group status may be a promising approach in the treatment and prevention of adolescent depression.

Strengths and Limitations

Strengths of the current study include (a) targeting of a juvenile sample with high and low depressive symptoms, a population still largely understudied in research on processing of facial affect, (b) utilization of naturalistic (photographs), salient (peers depicted), and truly ambiguous (blends of two emotions) stimulus material, (c) a study design that allowed for an investigation of processing of ambiguous facial expressions prior to and after a negative social experience, and (d) SDT as a method to adequately distinguish between perceptual sensitivity and interpretative bias.

Given that the psychological literature has thus far neglected how social exclusion can impact facial emotion processing in adolescents with depressive symptoms, it is important to note that the current study was a first attempt to investigate this association. The novel approach taken in this study and the current lack of other investigations on this issue in adolescents with depressive symptoms underscore the necessity for replication in larger samples. Several limitations of our study should be considered. First, we only focused on a subset of facial emotions. Research in adult samples suggests that depressive symptoms are associated with impaired processing of surprise (Harmer et al., 2009) or fear (Merens, Booij, Haffmans, & van der Does, 2008). Therefore, an examination of processing of these emotions in depressed youth would be interesting. Second, the mood induced by the Cyberball-game might differ from the mood experienced by those with clinical depression. Further validation studies are required before a generalization of the study results to clinically depressed individuals can be made. Finally, the cross-sectional design of our study did not allow for an investigation of developmental processes. Thus, we cannot conclude whether the aforementioned findings are a predictor or a correlate of depression. Longitudinal studies are required in the future to investigate this issue.

Conclusion

The present study is one of the first attempts to address the considerable knowledge gap regarding alterations in social cognition related to adolescent depression. The results suggest that depressive symptoms in adolescents may be associated with an altered processing of facial affect in partners with whom they experienced negative social interactions. In LD individuals, the experience of social exclusion appeared to trigger an increased perceptual sensitivity of happy expressions depicted by includer and stranger models, whereas HDs tended to exhibit an increased perceptual sensitivity to happy

expressions of excluder models. This may indicate an increased experience of incongruity or ingenuousness in HD and future studies are needed to further investigate the mechanism underlying the effect observed in this study. Furthermore, the present study is the first to show that depressive symptoms may not be associated with an interpretative tendency, but rather with alterations in perceptual sensitivity. Considering the highly implicit nature of such perceptual alterations, it is possible that this may be an important factor contributing to the emergence and maintenance of depressive symptoms by distorting early, as well as late processing stages. Future studies are needed to further investigate whether these implicit processing patterns can be addressed using traditional CBT approaches, or novel computerized training methods aimed at the perceptual deficiencies.

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Appendix

Manipulation Check: Cyberball

Mood ratings. To investigate the effects of the Cyberball experience on the participants' mood, a 4 (time: baseline, post-inclusion, post-exclusion and post-experimental assessment) x 2 (group: HD vs. LD) repeated-measures ANOVA was conducted. The results indicated a main effect of time ($F(3, 174) = 3.60$, $p < .05$, $\eta^2 = .06$, 90% CI [.01, .11]) and group ($F(1, 58) = 5.60$, $p < .05$, $\eta^2 = .08$, 90% CI [.01, .21]), with HD group scoring lower mood ratings at every assessment point. The general quadratic ($F(1, 58) = 4.65$, $p < .05$, $\eta^2 = .08$, 90% CI [.0, .2]) and linear ($F(1, 58) = 4.04$, $p < .05$, $\eta^2 = .07$, 90% CI [.0, .18]) trends indicated that the main effect of time is due to an overall tendency for decreasing mood ratings across the assessment points, with a peak of mood ratings following the inclusion experience.
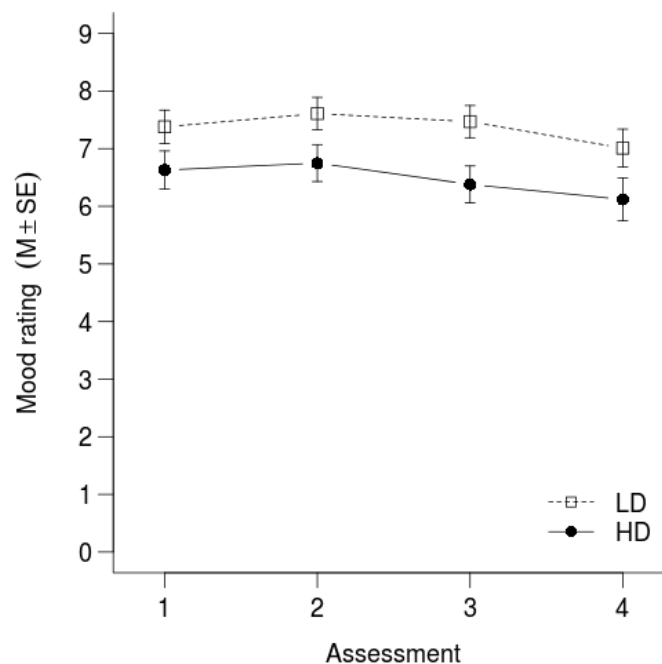

Figure A1. Mean rating scores for mood over four assessments for HD and LD group. Assessment 1 = baseline; assessment 2 = post-inclusion; assessment 3 = post-exclusion; assessment 4 = final assessment after the experimental task. HD = high depressive symptoms; LD = low depressive symptoms.

Model ratings. The next analysis was conducted to explore how the cyber-ostracism manipulation impacted the subjective ratings for the includer, excluder and stranger model pairs. For this purpose, mean scores were computed from the dimensional fairness and sympathy scores obtained for condition. The scores were then entered in a 3 (condition: includers, excluders, strangers) x 3 (time: baseline, post-Cyberball and post-experimental

assessment) x 2 (group: HD vs. LD) repeated-measures ANOVA. The results yielded a main effect of condition ($F(2, 116) = 20.39$, $p < .001$, $\eta^2=.16$, 90% CI [.15, .35]) and time ($F(2, 116)$ $= 9.37$, $p < .001$, $\eta^2=.14$, 90% CI [.05, .23]), which were further qualified by a condition x time ($F(4, 232) = 7.53$, $p < .001$, $\eta^2=.11$, 90% CI [.05, .17]) and a three-way condition x time x group interaction ($F(4, 232) =3.10$, $p < .05$, $\eta^2=.05$, 90% CI [.01, .09]). To investigate the interaction effect, 3 separate analyses were conducted for each assessment time. At baseline, a condition by group interaction emerged ($F(2, 116) = 5.05$, $p < .01$, $\eta^2=.08$, 90% CI [.01, .16]; all other ps $> .05$); however, post-hoc paired-samples t-tests for each condition did not reveal any significant differences between groups (all ps $> .05$). For the assessment point following the Cyberball-game, there was a main effect of condition ($F(2, 116) = 15.08$, $p < .01$, $\eta^2=.20$, 90% CI [.1, .3]) and a trend toward a condition x group interaction ($F(2, 116) = 2.67$, $p < .1$, $\eta^2=.04$, 90% CI [.0, .11]). The condition effect was due to lower mean ratings for excluder than for includer and stranger models ($p < .01$) as well as the interaction trend toward even lower ratings for excluding models in the HD group.

The results for the final assessment point at the end of the experimental task, indicated a main effect of condition ($F(2, 116) = 4.71$, $p < .05$, $\eta^2=.08$, 90% CI [.01, .15]; all other ps $> .05$), which was due to lower subjective ratings for excluder than for includer and stranger models ($p < .05$).
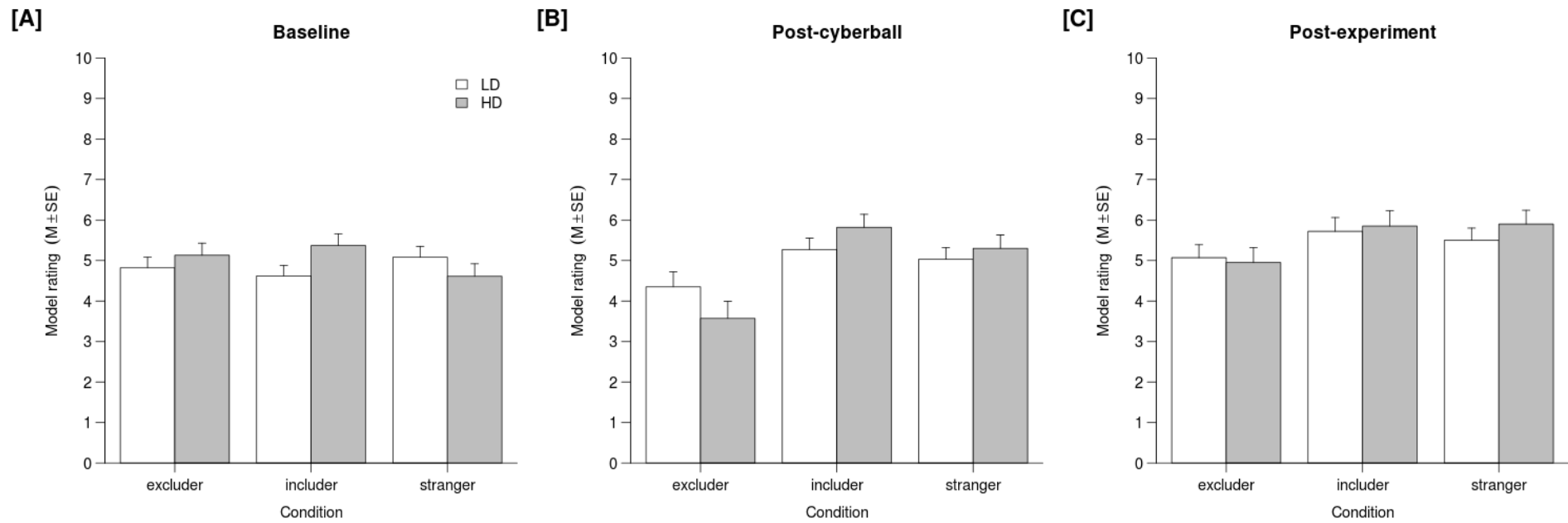
Figure A2. Mean rating scores obtained for includer, excluder and stranger models for LD and HD groups across different assessment points: A) Baseline assessment; B) Following the Cyberball-game; C) After completion of the experimental task. HD = high depressive symptoms; LD = low depressive symptoms.

9   GENERAL DISCUSSION

Adolescence is a critical period of intensive development in young individuals' lives. The changes and challenges adolescents are confronted with during this transitionary period might be especially difficult for individuals who suffer from emotional problems like depressive symptoms. Despite the high prevalence of depressive symptomatology in the adolescent population (Costello et al., 2006), the stability of symptoms (Lewinsohn et al., 1994), and the immense public health burden of depression for society (World Health Organization, 2008), many questions about the association between depressive symptoms and functioning in adolescence remain unanswered.

Following the theoretical rationale and current state of the literature, the present dissertation aimed to assess important research questions on adolescent depressive symptomatology at different levels of granularity. Study 1 of the current dissertation investigated consequences of internalizing problems on academic and social functioning in school. Study 2 assessed putative moderating factors hypothesized to influence the effectiveness of one school-based and one bibliotherapy-based depression prevention program for adolescents. Finally, Study 3 was an experimental study designed to detect potential alterations and their underlying mechanisms in depressed adolescents' social information processing.

In the concluding chapter of this dissertation, central findings of each study will first be summarized and discussed. In a subsequent section, the individual results will be integrated into the respective theoretical framework and existing body of literature. In the two following sections, implications for practice and future directions in research at the interface of clinical psychology and educational science will be elaborated. The chapter will close with a concluding statement.

9.1   Summary of Main Findings

Emphasizing the importance of school as a significant developmental context, Study 1 explored differences in academic (reading achievement, mathematics achievement) and social (self-rated acceptance, peer-rated acceptance, teacher-rated acceptance, relationship with parents) functioning of adolescents with versus without

internalizing problems (a) at fifth grade, and (b) over a time course from sixth through eighth grade. The study used data from adolescents who took part in the TRAIN Study (Jonkmann, Rose, & Trautwein, 2013); a longitudinal project designed to analyze lower- and intermediate-track students' development from fifth through eighth grade.

Main findings of Study 1. The main findings of Study 1 can be summarized as follows: At fifth grade, right after the transition from primary to secondary school, adolescents with internalizing problems were at a significant disadvantage (i.e., lower scores) in all investigated academic and social functioning domains compared to adolescents without such problems. Further, the results suggested that adolescents with internalizing problems (a) maintain this disadvantage over time (mathematics achievement, peer-rated acceptance and relationship in with parents), or (b) show even more disadvantaged development as compared to adolescents without internalizing problems (reading achievement and teacher-rated acceptance). Only in their self-rated acceptance did adolescents with internalizing problems show a more positive development over time than their non-troubled counterparts.

Early disadvantaged environments may serve to explain the finding that adolescents with internalizing problems showed worse functioning across all investigated domains than adolescents without such problems. Furthermore, adolescents with internalizing problems might experience the transition to secondary school as more challenging and difficult than adolescents without such problems. This explanation dovetails with previous findings indicating worse school transitions in children or adolescents with inhibitory tendencies (Gray, 1972) or anxiety (West et al., 2010). Importantly, adolescents with internalizing problems fail to make up for their disadvantaged position at fifth grade in all investigated functioning domains but self-rated acceptance. The observation that, over time, reading achievement is more impacted by internalizing problems than math achievement may be due to the importance of early literacy opportunities in the home environment which play a key role in the development of language and reading skills (e.g., Baker, Fernandez-Fein, Scher, & Williams, 1998; Bus, Van Ijzendoorn, & Pellegrini, 1995). Contrary to language skills, mathematics skills are taught in school to a far greater extent. Accordingly, compensating effects of the school may serve to explain the differences in effects between the achievement outcomes. The interesting difference in student-, peer-, and teacher-ratings of acceptance may reflect different perceptions of the informant. Adolescents with internalizing problems might take into account friends

outside of the classroom. These friends may offer sufficient support so that adolescents with internalizing problems do not feel a lack of acceptance at school. In fact, adolescents with internalizing problems show even more positive acceptance scores over time than adolescents without such problems. Aligned with this assumption and previous research (Brendgen et al., 2002), adolescents with internalizing problems were not judged worse by classmates than adolescents without such symptomatology. Contrarily, the more negative view on acceptance as rated by teachers suggests that individual students are referenced to the entire class. Finally, the relationship with parents showed a general deterioration for adolescents with and without internalizing problems alike, constituting a somewhat normative developmental trajectory (Steinberg, 1987). It is important to consider the fact that TRAIN is a community sample and result patterns may differ in clinical samples. In conclusion, the gap in functioning between students with and those without internalizing problems at fifth grade calls for the development and implementation of effective support or indicated prevention programs as early as in primary school (Heckman, 2006). Such programs might serve to prevent long-term manifestation of early disadvantages.

Main findings of Study 2. As a logical consequence of the Study 1 results, Study 2 focused on indicated prevention programs that may serve to reduce depressive symptoms as well as the risk for developing a depressive disorder. Specifically, Study 2 investigated eight putative individual, demographic, and environmental factors that might moderate the effects of a school-based cognitive behavioral group (CB group) and cognitive behavioral bibliotherapy (CB bibliotherapy) depression prevention program. The study combined data from two rigorous prevention trials, available from pretest until 2-year follow-up.

Five of the eight investigated putative moderating factors did not—neither positively, nor negatively— influence effectiveness of the depression prevention programs. In line with our hypotheses, posttest results indicated that both CB programs were more beneficial for adolescents who entered the study with at least moderate depressive symptoms. Additionally, the school-based CB group was more effective for youth with higher motivation to reduce their symptoms. Furthermore, the findings indicated that substance use reduces the effectiveness of school-based CB group depression prevention at posttest.

Converging with the evidence from previous studies (e.g., Horowitz & Garber, 2006; Jaycox, Reivich, Gillham, & Seligman, 1994; Stice et al., 2009), elevated initial depressive symptoms have emerged as one of the most robust moderators of depression prevention programs. This finding might be due to the fact that those with higher initial symptoms have a greater potential to show symptom reductions. Yet, also aligning with the moderation finding on motivation to reduce symptoms, these individuals should be more motivated and inclined to work on their symptoms because they experience a higher level of suffering. Contrary to the moderating effect of elevated depressive symptoms, motivation to reduce symptoms emerged as a novel moderator in depression prevention. However, the moderating effect of motivation to reduce symptoms is supported by a previous finding in treatment research which showed that motivation to reduce symptoms predicted patients' response to CB treatment (Keijsers, Schaap, Hoogduin, Hoogsteyns, & de Kemp, 1999). Several factors may be responsible for the finding that substance use reduced the effects of the school-based CB group program versus controls. Although group-based prevention programs provide a powerful context for change for most participating adolescents, individuals with high substance use might experience more negative outcomes in this social setting (e.g., confrontation, high emotional arousal, frustration). Moreover, previous findings suggest that substance use may decrease participants' motivation to actively engage in a program or apply the aquired skills (Brook et al., 2002; Gau et al., 2012). In conclusion, Study 2 suggests options for enhancing the effectiveness of indicated CB prevention programs such as implications about who should be included (those with elevated symptoms and higher motivation to reduce depression) or excluded (high substance users) from the school-based CB group program, and—to a smaller extent—from the CB bibliotherapy program.

Main findings of Study 3. The special focus of Study 3 was on the investigation of alterations in facial affect processing related to adolescent depression, the association of these alterations with social experiences, and the underlying mechanisms driving these alterations (perceptual sensitivity vs. response bias). Adolescents with high and low depressive symptoms participated in an emotion recognition task in which they were asked to indicate the predominant affective expression in ambiguous stimuli of varying intensity (morphs of angry, happy, and sad expressions). The emotion recognition task was carried out prior to and following an excluding (being excluded in the Cyberball-

game), including (being included in the Cyberball-game), or no social experience with the depicted model identities.

At baseline, the results suggest no general difference in emotion recognition, perceptual sensitivity or response bias between those with high versus low depressive symptomatology at baseline. Following the social experience, however, those with lower depressive symptoms showed an increase in perceptual sensitivity for happy facial expressions of models who had previously included them (includers), or with whom they did not have a previous interaction (strangers). In contrast, for adolescents with high depressive symptoms, an increased perceptual sensitivity emerged for processing of facial affect in partners who had previously rejected them (excluders).

Although the lack of baseline differences runs counter to some literature documenting alterations in adults (e.g., Bouhuys et al., 1999; Geerts & Bouhuys, 1998; Hale III, Jansen, Bouhuys, & van den Hoofdakker, 1998; Joormann & Gotlib, 2006; LeMoult, Joormann, Sherdell, Wright, & Gotlib, 2009; Liu et al., 2012), it aligns with research suggesting no differences in the identification and processing of full-blown emotions in dysphoric (Beevers, Wells, Ellis, & Fischer, 2009; McClintock, Husain, Greer, & Cullum, 2010) as well as depressed populations (Gollan, McCloskey, Hoxha, & Coccaro, 2010; Milders, Bell, Platt, Serrano, & Runcie, 2010). Most importantly, the finding parallels with the only previous study using truly ambiguous stimuli in a high-risk pediatric sample (Lopez-Duran et al., 2013). The pattern of results for adolescents with low depressive symptomatology suggests adaptive orientation toward accepting social partners or those with whom no previous social experience had occurred. In contrast, the higher perceptual sensitivity of happy excluder expression in adolescents with higher depressive symptomatology may indicate an increased experience of incongruity or an increased impression of ingenuousness, an assumption underscored by a previous finding that social exclusion led to increased sensitivity for real versus posed smiles (Bernstein, Young, Brown, Sacco, & Claypool, 2008). In sum, Study 3 constituted a first attempt to investigate altered processing of facial affect in adolescents with high and low depressive symptoms and the association of these alterations with social experiences. The findings not only highlight the importance of situational aspects (i.e., activation of depressive schema due to a social experience) in facial affect processing of adolescents with high depressive symptoms but also that it is perceptual sensitivity—not response bias—driving this process. Whereas this study represented an important first

step, replications are needed to gain confidence in the results. In the future, knowledge about altered processing of facial affect might be introduced in traditional CB therapy or prevention approaches in order to reduce perceptual social processing alterations.

Taken together, the results of the studies presented within this dissertation highlight the relevance and impact of depressive symptomatology in adolescence. Precisely, the new evidence gained in the present dissertation emphasizes not only the disadvantages and maladaptive development in functioning over time (Study 1) but also the underlying processes associated with functioning difficulties on a more basic level (Study 3). Consequently, another main focus of this dissertation was put on the exploration of (school-based) indicated prevention programs that may serve to prevent or reduce manifestation of functioning difficulties. Here, important knowledge was gained about several individual characteristics that may heavily impact the success or failure of generally effective indicated prevention efforts (Study 2). In the following section, several important aspects of the present dissertation will be emphasized and integrated into the respective theoretical background and literature body.

9.2   Integrated Discussion of Main Findings

This section describes important aspects, central to the current dissertation and fundamental to the subsequent deduction of implications for practice as well as future directions in research. First, the school context will be discussed as a multi-relevant environment for adolescents with depressive symptoms. Second, the results of this dissertation with regard to indicated depression prevention efforts in adolescents will be discussed in the broader context of the important field of prevention science. And finally, the significance and influence of social factors in different facets will be discussed in the context of adolescent depression.

School: a multi-relevant environment for adolescents with depression. The school is clearly a system of central importance in the lives of all adolescents fortunate enough to receive an education. Not only do adolescents spend more time in school than in any other place or institution outside their home environment (Eccles & Roeser, 2009; Rutter et al., 1979), the school environment is also thought to be a context in which not only curricular knowledge, but also social and emotional skills can be fostered and expanded (Bergmüller, 2007; OECD, 2015).

However, whereas the school context generally constitutes an environment of academic and social growth and development, this is unfortunately by far not true for every individual. From a theoretical perspective, this notion underlies the seminal stage–environment fit model proposed by Eccles and Midgley (1989). According to the stage–environment fit model, optimal development in a specific context (i.e., the school) occurs when the needs of an adolescent and the opportunities provided by the school match. Clearly, this may often not be the case—especially not in adolescents with mental health problems like depression who, due to their specific pattern of symptoms (e.g., concentration difficulties, withdrawal, peer difficulties), might experience more challenges in school than their healthy classmates. It is important to emphasize that in this sense, Eccles and Midgley were the first to really bring together aspects of clinical psychology and educational science to be combined into a developmental psychology model.

The findings in Study 1 of this dissertation fit well into this theoretical framework. In line with the proposition of the stage–environment fit model, adolescents with internalizing problems (stage) showed worse functioning outcomes in school (environment) than adolescents without such problems. Study 1 clearly suggests that adolescents with internalizing problems are at a tremendous disadvantage in dealing with different relevant academic and social functioning domains. Importantly, the gap in functioning between students with and without internalizing problems is not only evident right after the start of their secondary school career, it also widens or gets worse for several functioning domains. Accordingly, for adolescents with internalizing problems the misfit between their psychological stage and the environment is not a static phenomenon but is rather observable over a longer period reaching far into the years of secondary education.

A second point that underscores the relevance of the school context in adolescent depression is the way in which functioning difficulties in school develop and manifest over time. Although difficulties of the internalizing spectrum are often less obvious than externalizing behavior problems (Walker & Severson, 1992), and thus less disturbing in the classroom, the variety of functioning difficulties detected in Study 1 require attention. Adolescents with internalizing problems enter secondary school with lower achievement scores in both reading and mathematics, and show less growth in reading achievement over time, suggesting that these will likely require special attention from their teachers

because they have more academic difficulties than adolescents without internalizing problems. Furthermore, the consideration of academic problems in adolescents with depressive symptomatology is not only vital because of proximal consequences in class. In fact, it is also known from previous research that academic difficulties can in turn lead to a variety of subsequent emotional or behavioral difficulties (e.g., drug use and abuse, failure to complete high school) in and outside of school at a later point in adolescence (Roeser, Eccles, & Strobel, 1998). With respect to social functioning, Study 1 suggests that teachers recognize the lower social status in adolescents with depressive symptoms. Moreover, it has been shown that problematic peer relations and low acceptance increase the risk for later life difficulties (Parker & Asher, 1987).

The importance of the school context as a developmental environment for adolescents with depressive symptomatology and the repercussions of depressed adolescents' functioning problems on the school context itself (e.g., teachers, classmates) warrant a reconsideration of the role of the school in Cicchetti and Toth's etiological–transactional model (1998). Specifically, in the etiological–transactional model the school context is embedded into the exosystem and thus less proximal to an adolescent's life than the microsystem (i.e., the family). In other etiological models—although not specific to the etiology of adolescent depression—school is integrated on a microsystem level (e.g., Bronfenbrenner, 1979). Based on the study results presented in this dissertation, the categorization of the school as a more distal level in the etiological–transactional model should be reconsidered.

Finally, contemplating the school context on a broader level, it is an environment in which research can be conducted and the research findings can be implemented. All three studies presented in this dissertation have completely (Study 1) or partly been conducted in schools (Studies 2 and 3). Moreover, the sessions for the indicated group-based prevention program in Study 2 were facilitated in schools. Accordingly, the school context is not only a powerful environment because it allows for depressed adolescents' functioning to be observed and assessed, but also because it provides a context in which depressed adolescents' functioning can be changed, for instance through prevention efforts.

Prevention efforts. The investigation of putative moderators of intervention effects is important for many reasons such as to determine who is most or least likely to benefit from a program, who should be included or excluded from a program, or how a

program should be refined. The research community has long focused their interest in putative moderators of prevention effects mainly on demographic factors, such as gender. Fortunately, some single trial prevention studies, combined into meta-analyses on depression (e.g., Horowitz & Garber, 2006; Stice et al., 2009) but also other mental health problems (e.g., eating disorders; Stice & Shaw, 2004) have made a pivotal contribution to the knowledge we have today about factors that moderate prevention programs (please refer to Chapter 4.2 for a concise summary). Such general knowledge can help to guide prevention research. However, one must consider the fact that there is a wide variety of different prevention programs (i.e., universal versus selective or indicated programs; individual versus school-based programs). Accordingly, it is vital that researchers, who develop programs with intentions of providing them to the general public, are aware of the moderators relevant for "their" specific or similar programs. This knowledge will serve to draw appropriate conclusions with regard to inclusion and exclusion criteria as well as program refinement. Study 2 of the present dissertation constitutes such a rigorous investigation of putative moderators of individual, demographic, and environmental nature of two indicated depression prevention programs. Findings of such studies not only lead to important implications for the dissemination of specific programs, but also can serve to "personalize" prevention to the needs of the individual. This is an important consideration when contemplating ways to reduce the public health burden of depression.

The concept of "personalized medicine" is the center of a relatively new and rapidly growing field that has mostly been discussed in the context of pharmacogenomics. Due to the lack of a clear consensus on the definition of personalized medicine, a proposal was put forward by the authors of a recent systematic literature review on the topic: "Personalized medicine seeks to improve stratification and timing of health care by utilizing biological information and biomarkers on the level of molecular disease pathways, genetics, proteomics as well as metabolomics." (Schleidgen, Klingler, Bertram, Rogowski, & Marckmann, 2013). Clearly, this definition is not thought to apply to treatment or prevention of mental health disorders. However, in the broader sense of mental health prevention, one may consider the purpose of "personalized prevention" to be the identification of optimal prevention strategies tailored to each individual to maximize the benefits of prevention and minimize adverse effects. Thereby, moderator research might be able to bridge the originally biological definition of personalized

medicine and integrate a psychological conceptualization that can impact the view we have today on prevention and treatment of mental health problems.

The association between depressive symptoms, social functioning, and social cognition. One of the most central aspects of the current dissertation is the strong emphasis on the facets of social functioning associated with adolescent depressive symptomatology. The findings on social factors associated with adolescent depression integrate well into the current body of literature that emphasizes the importance of the interpersonal domain in adolescent depression. Interpersonal theories of depression (e.g., Coyne, 1976) and more specific models for the etiology of depressive symptoms in children and adolescents (Cicchetti & Toth, 1998) have rightfully emphasized the significance of social factors in the emergence and maintenance of depression. For instance, socioemotional systems (e.g., interpersonal relations) represent the key components constituting the depressotypic organization in the etiological–transactional model. Similarly, social cognition and social information processing constitute essential components of the cognitive systems represented in the depressotypic organization. On a more fundamental level, models of information processing, like the reformulated social information processing model be Crick and Dodge (1994) and the integrated model of emotion processes and cognition in social information processing (Lemerise & Arsenio, 2000) integrate well into the broader framework proposed in the etiological–transactional model.

In their proposals for future direction in research, Lemerise and Arsenio (2000) call for studies investigating how individual differences in emotionality and emotion regulation may influence social information processing. The authors further call for investigations of how mood induction or situational manipulations will influence social information processing. The research design used in Study 3 attended to both suggestions and showed that it was only after a social manipulation that alterations in facial affect processing were observable in adolescents with high depressive symptomatology. Clearly, on the basis of theoretical and empirical implications, one can hardly investigate depressive symptomatology without taking into account the importance of the social domain. This is especially true for adolescents, because social relationships outside of the family generally become even more important during this time (La Greca & Prinstein, 1999). Moreover, depressive symptoms are to a large extent manifested within the social domain.

Taken together, this section included a more general and comprehensive discussion of important findings and elements of the three studies. As a consequence of our findings as well as other empirical and theoretical implications, the multi-relevance of the school context was highlighted. Moderation analyses in prevention science were discussed in the light of personalized medicine, and personalized prevention was proposed as a framework for effective prevention efforts in mental health. Finally, the centrality of the social domain was underscored by the integration of main research findings of this dissertation into a broader theoretical context. Derived from the considerations in this section, the implications for practice will be discussed in the following.

9.3   Implications for Practice

A central component of "good" research is not only that research is well done (e.g., by utilization of sound methodology; Hostetler, 2005) but also that it accomplishes worthy goals for the benefit of both individuals and society (Brickhouse, 2006). In this sense, the question of what comprises good research is mostly an ethical than merely a methodological one. Integrating the specific findings in the three studies of this dissertation into the broader literature body, this section is centered around implications that can be derived for practitioners working with adolescents with depressive symptomatology, or in an environment in which these adolescents interact.

Implementation of school-based support and prevention efforts. The implications of the findings in Study 1 of this dissertation dovetail with recommendations made in the World Health Organization's Global School Health Initiative (World Health Organization, 1996) that emphasizes the importance of school-based efforts to promote mental health in children and adolescents. The researchers and practitioners involved in the development of strategies to promote mental health acknowledge the importance of school as an environment relevant not only to the acquisition of academic skills but also for the development in emotional and social domains (Spence & Shortt, 2007). However, considering the costs associated with the implementation of intervention and prevention in school, decision-makers at the different levels of approval (i.e., government officials, school principals, teachers, and parents) are faced with important cost–benefit considerations. Moreover, the wealth of available interventions and prevention efforts of

adolescent depression makes it more difficult for non-scientists to make informed choices that take the specific needs of their community into account *and* are based on scientific evidence.

Roughly ten years ago, the Society for Prevention Research (SPR) created a set of standards to guide policy makers' and practitioners' in choosing efficacious, effective, and appropriate prevention programs for implementation and dissemination. Not only were the guidelines articulated in a contribution in *Prevention Science* (Flay et al., 2005), a concise summary was also provided on the SPR's website (http://www.preventionresearch.org/StandardsofEvidencebook.pdf). The most important guidelines can be summarized as follows: before a specific intervention or prevention program is implemented, the program must show (a) evidence that it meets criteria of both efficacy (beneficial effects under controlled conditions of delivery) and effectiveness (beneficial effects in real-world conditions), (b) the capacity to be implemented at a population level, (c) to be cost-effective, and (d) that tools for monitoring and evaluation of the intervention or prevention are available throughout dissemination. Although a decade old, the SPR standards provide an excellent framework to guide policy-makers' and practitioners' decision-making regarding prevention program implementation. It is important to mention that in 2015, the SPR proposed new standards of evidence (Gottfredson et al., 2015), however the value of this revision for practitioners has rightfully been called into question (Biglan, Flay, & Wagenaar, 2015). Considering the fact that there are a multitude of available programs, that schools are often overburdened with other priorities, and that the implementation in school is associated with considerable challenges, the original SPR set of guidelines for dissemination pose an important directive for decision-makers in school practice.

Directions for schools: school transition programs and prevention classes. Previous research clearly suggests that school transitions play a key role in the developmental processes of children and adolescents. Alongside with the socio-economic status, low academic achievement, gender, and prior behavioral problems have emerged as factors that decrease the likelihood of successful school transitions (Anderson, Jacobs, Schramm, & Splittgerber, 2000). Research evidence suggests that adolescents with internalizing symptomatology show particularly pronounced difficulties during and after school transition (Gray, 1972; West et al., 2010). Accordingly, these findings lead to a critical question: what can be done to facilitate school transition for students with mental

health problems, like depression? This question is best discussed in a theoretical framework. Anderson and colleagues (2000) proposed that for transitional success or failure, preparedness and support play a key role. In this framework, preparedness includes academic preparedness, independence and industriousness, conformity to adult standards, and coping mechanisms. Support includes informational, tangible, emotional, and social support that can be provided by different people in the environment of students, such as parents, peers or teachers. The authors state that the importance of support is inversely related to the extent of student preparedness for the transition. This is an important aspect of the framework and requires particular attention in students with internalizing problems, who—due to their symptomatology—are likely to be less prepared for school transition. Thus, these students may require more attention and support than their non-troubled peers. Transition support programs might offer a suitable approach to assisting youth going through school transitions.

Several factors should be attended to when designing school transition programs for students with internalizing problems. First, successful school transition programs should involve parents (e.g., Cooke, 1995). Parents involved in the school transition process have been shown to stay involved in their child's education at the next school level (Mac Iver, 1990). Furthermore, communication between parents and teachers will improve if parents participate in the school transition process (Deller, 1980). Conclusively, parents are able to better motivate their children to participate in school transition programs if they do so themselves (Perkins & Gelfer, 1995). In addition, the home environment plays a key role in the academic as well as social development of children (Heckman, 2006). Thus, an interchange between home and school environment is clearly advisable. Second, secondary schools should aim to create a sense of community and belonging (Anderson et al., 2000). Developing a sense of belonging might be especially hard for students who suffer from internalizing symptoms that tend to manifest in the interpersonal domain. For instance, students who experience anhedonia or show withdrawal might have a harder time experiencing a good sense of belonging in their new school. Finally, school transition programs should be comprehensive, i.e., carefully planned, multi-faceted, and have a long-term perspective (Anderson et al., 2000). If all these aspects are attended to, students with internalizing symptoms will likely experience smoother school transition. In light of the results of Study 1, school transition programs

tailored to those with internalizing problems pose a desirable direction for efforts in practice.

When, thinking about prevention on a broader level, one must realistically consider whether a real impact on society can ever be achieved as long as decisions on program implementation in school are made very selectively and in large parts depending on local decision-makers' preferences. Over the past few years, several German politicians have discussed or even demanded that schools provide students with a class on prevention the same way they get taught science or language in other classes. These proposals have ranged from establishing a class on drug and alcohol prevention ("Unterricht gegen Alkoholmissbrauch", 2009), teaching knowledge about nutrition and food in order to prevent obesity ("Prävention zwischen Wunsch und Wirklichkeit", 2014), to incorporating a class on "happiness" into the curriculum ("Neues Schulfach "Glück"", 2007). Although these proposals are often rather superficial and not based on exhaustive evidence, they highlight the general desire for strategies to prevent or decrease the major public health burden that arises from behavioral problems and mental health issues in the child and adolescent population.

Surely, today we are far from implementing a comprehensive class on health and prevention in German schools. However, a real joint effort between policy makers, practitioners and researchers could be an important first step toward the development and integration of such a class into the school environment.

Networks between schools, families, and mental health care providers. A real joint effort and interchange between family and professionals involved in the lives of adolescents with depressive symptoms—especially in early and middle adolescence—is desirable over and beyond the context of intervention and prevention implementation in school. In fact, adolescents with depressive symptoms interact in multiple environments outside of the school. Considering the functioning problems that emerged in Study 1, and—on a more basic research level—the altered processing patterns observed in Study 3, it would be naïve to disregard the implications of these problems in other environments. If the interchange of information between different environments increases, all parties are more likely to gain a better understanding about the depressive symptom patterns and the specificity of problems a particular adolescent faces. In consequence, this richer view on the adolescent's problems may serve to provide a more comprehensive system of support and can help to guide specific, "personalized" treatment approaches. For instance, mental

health care providers (i.e., therapists) benefit greatly from information they receive from parents about the adolescent's behavior at home and from teachers about the adolescent's behavior in school. Conversely, mental health care providers may provide parents or teachers with information about ways in which they can foster and encourage a depressed adolescent to apply the skills taught in programs or therapy sessions to day-to-day life. Thus, it is in the best interest of adolescents with internalizing problems as well as those in their surrounding environments, that support networks are formed by pooling resources.

Implications for teachers. Because of the large proportion of time that adolescents spend in school, they spend a lot of time in the presence of their teachers. Consequently, teachers have been referred to as 'front-line' observers of adolescents' mental health problems (Rothì, Leavey, & Best, 2008). In addition to the delivery of curricular knowledge, there is an increasing expectancy for teachers to be able to identify mental health problems in their students and provide appropriate referral to medical and psychological services (Department of Health, 2004; NHS Health Advisory Service, 1995). Clearly, teachers are ideally placed to detect warning signs of mental health problems (Bostock, Kitt, & Kitt, 2011). However, it is vital to realistically consider whether teachers can spot mental health problems and make judgement calls about whom to refer to mental health care providers.

Evidence suggests that teachers feel insufficiently prepared to carry these responsibilities, in part due to the above-mentioned lack of policies on how mental health problems should be managed (Rothì et al., 2008). Teachers further emphasize that they are not mental health experts and that they need expert advice on mental health that is tailored to the needs of teachers in the school context. Research evidence gives indications about the appropriate timing for such mental health awareness trainings. Bostock, Kitt, and Kitt (2011) found that students who train to become teachers show a more positive attitude toward taking on responsibility in child and adolescent mental health services than teachers who are already more experienced. Accordingly, Bostock and colleagues make a case for including mental health awareness training in teacher education curricula. Clearly, these authors touch on an important topic. For instance, students going for the teaching profession receive no or only very limited education on mental health problems in German universities. It is likely that aspiring teachers would place a different emphasis on their responsibility to spot mental health problems in students if this kind of education

was an integral component of the curriculum. Specifically with regard to the detection of the less disruptive (though potentially heavily debilitating) internalizing problems, a big opportunity lies in early mental health awareness training in teacher education.

Nevertheless, it is important not to push the limits too far. Teachers are education professionals, not clinicians. They cannot and should not be expected to be able to diagnose mental health disorders. Nevertheless, a stronger emphasis on the sensitization for mental health problems in the training of aspiring teachers may immensely benefit adolescents with mental health problems. In fact, an attempt in this direction may constitute an integral step for improving mental health services for youth in the long run.

With regard to prevention and intervention efforts in school, previous research highlights the capability, competence, and interest of teachers to take on responsibilities with regard to adolescent mental health. For instance, interventions on internalizing as well as externalizing symptoms delivered by teachers have been shown to significantly impact mental health outcomes over two-year follow-up (O'Leary-Barrett et al., 2013). In accordance with this finding, a systematic review of Australian school-based prevention and early intervention programs for internalizing symptoms suggests that effectiveness of the reviewed programs was uninfluenced by the type of instructor (i.e., teachers versus psychologists). However, it is important to note that other research suggests that teacher-led depression prevention programs show weaker or lesser effects than psychologist-led programs (e.g., Calear & Christensen, 2010; Stice et al., 2009). Similar evidence also exists for German prevention efforts (e.g., the LARS & LISA program; Wahl, Adelson, Patak, Pössel, & Hautzinger, 2014). Thus, on the basis of the inconclusive nature of current findings, no general recommendations can be made regarding teacher-led programs. Leading back to the earlier discussion on guidelines for implementation of evidence-based programs, teacher-led programs should only be implemented and widely disseminated if they have successfully passed rigorous investigations in efficacy and effectiveness trials.

In sum, guided by the research findings, the present section highlighted important implications for practice, including the need for

>   (a) efficacious, effective, and appropriate intervention and prevention efforts for adolescents with depressive symptoms,
>
>   (b) considerations regarding school transition programs, and a class on health and prevention,

(c) active interchange between schools, families, and mental health care providers, and

(d) mental health awareness trainings in teacher education.

9.4 Future Directions in Clinical Psychology and Educational Science

In this section, implications of the present dissertation for future research will be discussed (a) on an integrated level, combining ideas from clinical psychology, educational science, and developmental psychology, and (b) on a more specific level with regard to future avenues derived from the findings of the three studies.

Interdisciplinary research as a key to a better understanding of adolescent depression. One of the main strengths of this dissertation is the integration of different fields of research, precisely clinical psychology and educational science, taking into account theoretical concepts and empirical findings from developmental psychology. This combination of disciplines not only includes different theoretical foundations but also various methodological approaches and designs to study depressive symptoms in adolescence. The present dissertation used data from large samples in longitudinal field trials to assess academic and social functioning (Study 1) and moderators of depression prevention programs (Study 2), as well as a controlled experimental design to study the underlying processes of social information processing in adolescents with depressive symptoms (Study 3). Furthermore, the materials used to assess the outcomes in the respective studies reached from self-report questionnaires (all three studies) and questionnaires from other informants (i.e., parents, teachers; Study 1) to semi-structured diagnostic interviews (Study 2) and behavioral measures (*beta* and *d-prime* in the emotion recognition task of Study 3). Finally, the studies presented in this dissertation used advanced statistical methods to assess the respective research questions. Specifically, growth models as well as sophisticated analysis methods derived from signal detection theory were used.

The integration of theory and background, as well as design and methodological approaches from different disciplines offers ideal opportunities to investigate depressive symptoms in adolescence from different perspectives and at different levels of granularity. Ideally, future research efforts should further take advantage of these opportunities by using interdisciplinary approaches to investigate questions of interest.

An important implication for future research is the integration of clinical measures in educational science trials, and achievement measures in clinical psychology trials. For instance, clinical measures are often absent from educational science trials today. This is an unfortunate circumstance, considering the substantial number of adolescents with depressive symptomatology. In fact, information from clinical measures could serve to provide a more differentiated pattern of the specific academic and social development of adolescents with depressive symptoms. It is thus desirable that clinical measures become integral components of future educational science field studies. However, it is important to consider that the conceptualization of the current measures used to assess mental health problems in school are worthy of improvement. Although measures such as the Child Behavior Checklist (CBCL; Achenbach, 1991) have been shown to possess good reliability and validity, they represent a diagnostic assessment of the status within the last few days or weeks. For an assessment of adolescent development over longer periods, other measures might be more appropriate. In the context of clinical psychology, ambulatory assessments have been discussed as another preferable method to assess symptoms, behaviors, and even physiological processes in recent years. Ambulatory assessments allow for real-time assessment and thus are not susceptible to retrospective bias, which is a problem that applies to most questionnaires and clinical interviews (Ebner-Priemer & Trull, 2009). Among other benefits, it has been argued that this method enhances generalizability, provides an ideal opportunity to investigate within-person processes, and allows for the assessment and investigation of context-specific relationships. In their article on ambulatory assessment in school, Bugl, Schmid, and Gawrilow (2015) emphasize the benefits of this method for the assessment of intra-individual learning processes. However, the authors acknowledge that the application of ambulatory assessments is not without drawbacks. Such drawbacks include concerns regarding data protection and internal validity as well as extensive use of financial, human, and time resources required for successful application of ambulatory assessment methods (Bugl et al., 2015). Nevertheless, ambulatory assessments constitute a promising approach for the investigation of specific experiences of adolescents with depressive symptomatology.

In the context of depression prevention efforts, considerations of novel outcome measurement approaches deserve attention. To date, most trials in depression prevention research in adolescents use self-report questionnaires or clinical interviews. Surely, this

kind of information is important to gain insights about whether or not depressive symptomatology or depressive disorder onset is influenced or changed by depression prevention programs. However, questionnaires and interviews are not designed to detect changes in more subtle processes that may be influenced by prevention efforts (Ebner-Priemer & Trull, 2009). It may very well be the case that preventive effects are not reflected in questionnaires and clinical interviews but do emerge on a more implicit level of processing. Experimental approaches like the one used in Study 3 could be included into the pre- and posttest measurements of depression prevention program effects like the ones in Study 2. Hence, future research could investigate whether the alterations following social experience observed in Study 3 would decrease or disappear after participation in an efficacious and effective depression prevention program.

Finally, implications for future research not only pertain to specific suggestions for future studies, but also to more general organizational aspects of research. Many researchers work within the boundaries of their specific disciplines—a circumstance that is often due to the specific orientation and interest of their specific work-group or organization. Although much highly valuable knowledge stems from research confined to a specific discipline, the present section clearly highlights the benefits of interdisciplinary work. Interdisciplinary graduate schools that encourage young researchers to take on a more comprehensive perspective on their particular field of interest are an important step toward more integrative research efforts (Holmes, Craske, & Graybiel, 2014). Moreover, the establishment of research networks in which scientists from different disciplines combine their knowledge and abilities may be an additional suggestion for future advances in research practice.

General recommendations regarding samples and specificity. Before discussing future directions in research with regard to each of the three studies in this dissertation, some more general aspects must be acknowledged: sample characteristics and disorder specificity. The sample used in Study 1 of this dissertation was a large representative sample of lower- and intermediate-track students in a particular region in Germany. Although the size of the sample—and thus the power to detect effects—increases confidence in the results, generalizability of the results is limited. The sample lacked diversity and it is unclear if the same pattern of findings would emerge in more diverse samples or other cultures. Therefore, future studies should aim to replicate the findings in other cultures. Similarly, the sample used in Study 2—although more diverse

than the Study 1 sample—was an American sample and accordingly, results cannot readily be generalized to other cultures. Even if a particular program has proven to be efficacious and effective in a particular country, the effects need to be replicated in the country in which it is intended to be implemented and disseminated. The more differences between the cultures involved in such a translation, the more caution is warranted.

The results found in Studies 1 and 3 clearly showed that adolescents with internalizing problems or depressive symptoms differed significantly from healthy adolescents with regard to their functioning. Although both studies have provided an important contribution to closing gaps in the current body of literature, no statements can be made regarding the specificity of the results for the mental health problems investigated. To disentangle this problem, a follow-up study based on the findings of Study 1 should also look at developmental patterns in functioning of adolescents with externalizing problems. Furthermore, a replication study of Study 3 should aim to elucidate whether the alterations in facial affect processing are exclusive to adolescents with depressive symptomatology or whether they also emerge in those with other mental health problems (e.g., externalizing problems).

Long-term consequences of depressive symptoms in adolescence. Evidence from this dissertation shows that internalizing problems have a detrimental impact on both academic and social functioning. Precisely, the pattern of findings suggests that the disadvantages for those with internalizing problems are especially pronounced immediately after the transition to secondary education and exacerbate for at least some academic and social functioning domains (reading achievement and teacher-rated acceptance) over time. The consideration of academic and social problems is not only vital due to their proximal consequences in class. In fact, difficulties in these functioning domains have been shown to increase the risk for maladaptive outcomes in later adolescence including drug use and abuse and failure to complete high school (Roeser et al., 1998). Moreover, Anderson, Jacob, Schramm, and Splittgerber (2000) emphasize that all transitions, including the one from school into work, require far more attention than is given to them today. Accordingly, future studies should aim to investigate the impact of depressed adolescents' functioning difficulties on academic and social life success over a longer period of time. Taking into account the importance of transitionary experiences, future studies should further aim to investigate how depressive problems in secondary school impact the transition into work.

Future directions in research on (school-based) depression prevention programs. In addition to the above-mentioned proposal of investigating the effects of depression prevention programs by using experimental paradigms, several other general considerations for future directions in depression prevention research should be mentioned. First, considering the generally small effects for depression prevention programs, it will be vital to replicate the most promising programs and design improved versions of those programs that have worked best in the past (Stice et al., 2009). Second, combining trials to enhance power to detect effects has emerged as a suitable method for the investigation of moderators. Third, researchers should aim at using more rigorous research designs (e.g., interviews instead of or in addition to questionnaires, longer follow-up periods, active control-groups). Thereby, such research designs will allow for more sound and reliable investigations of moderators. Fourth, peers who had previously participated in a prevention program should be considered as an appropriate alternative to research staff or school personnel facilitators in school-based prevention programs. Peer facilitators have been used in multiple effectiveness trials on a variety of health topics, such as HIV/AIDS prevention, smoking prevention, and alcohol and other substance use prevention (for a review, see Ebreo, Feist-Price, Siewe, & Zimmerman, 2002) as well as eating disorder prevention (e.g., Becker, Bull, Smith, & Ciao, 2008). To date, trials investigating peer-led programs are lacking in the field of depression prevention. Considering the importance of the interpersonal domain in adolescent depression, using peer facilitators may provide a promising future direction in depression prevention research. On a more general level, having peers facilitate school-based programs may be beneficial because adolescents consider peers of similar age as an especially reliable source of information. Further, peer facilitators may serve as authentic role models for desirable behavior. Also, having peers facilitate school-based depression prevention programs will be less costly than using professionally trained personnel. Finally, peers who volunteer to facilitate prevention programs may benefit from taking on a leadership position, giving back to their community, and developing valuable skills (Marchand, Stice, Rohde, & Becker, 2011).

Follow-up studies on facial affect processing in adolescents with depressive symptoms. The last study of this dissertation was a first seminal step toward a better understanding of social information processing patterns in adolescents with depressive symptomatology. A novel aspect of this study was the inclusion of an externally valid

virtual ball-tossing game to operationalize social experiences of peer inclusion and exclusion—an issue of great relevance in adolescent depression (Platt, Kadosh, & Lau, 2013).

Several implications can be derived from the findings. First and foremost, the findings underline the importance to operationalize social experiences that might activate depressotypic schema in adolescents with depressive symptoms. This observation aligns with Lemerise and Arsenio's (2000) social information processing model that states that the emotional status or the current mood of a person may affect all of the six proposed information processing steps. Accordingly, based on the findings and the theoretical framework by Lemerise and Arsenio, future studies should continue to investigate outcomes of interest (e.g., facial affect processing) at baseline and following a social experience manipulation. Second, the results underscore the relevance of examining not only the specific effects but also the underlying processes present in facial affect processing in adolescents with depressive symptomatology. The investigation of the exact mechanisms of the observed alterations (i.e. disentanglement of whether bias vs. perceptual sensitivity), may further shape the current understanding of adolescent depression. Future studies should aim at employing methodologically elegant approaches to even better differentiate between bias and sensitivity (A Jusyte, Mayer, Künzel, Hautzinger, & Schönenberg, 2015). Precisely, whereas a statistical approach was chosen to disentangle bias and sensitivity in the current dissertation, future studies could also target this issue by investigating bias and sensitivity in individual paradigms. Two-alternative forced-choice as well as continuous flash suppression tasks may offer adequate paradigmatic approaches (Stein, Hebart, & Sterzer, 2011). Finally, as mentioned previously, to determine whether the results are specific to adolescent depression or are rather a representation of a more general distortion, future studies should include participants with other mental health problems.

Taken together, the present section highlighted important general implications for future directions in research, including a stronger interchange between disciplines, and recommendations that can increase generalizability and conclusions about specificity. Derived from the implications of each individual study presented within this dissertation, the current section further provided suggestions for future research endeavors

9.5 Conclusion

In sum, adolescence is a time of extensive change and challenge in the lives of young individuals. Although most adolescents have been shown to deal with these challenges in a well-adjusted way, a substantial number of adolescents experience pronounced emotional and behavioral difficulties during this time. As one of the most common mental health problems during adolescence, depressive symptoms are associated with high stability and a variety of associated functioning difficulties in multiple life domains. Emphasizing the importance of school as a developmental environment, the present dissertation revealed the disadvantaged position of adolescents with depressive symptoms regarding various domains of functioning as well as social information processing. The dissertation also contributed to advances in the promising field of (school-based) depression prevention by detecting moderating factors that enhance the effects of cognitive-behavioral depression prevention programs. By combining theoretical and methodological concepts from multiple disciplines (i.e., clinical psychology, educational science, and developmental psychology), the present dissertation contributed importantly to the current research body on depressive symptoms in adolescents. Moreover, the findings presented here lead to tentative recommendations for practitioners and policy makers, as well as novel ideas for future investigations linking various disciplines. To conclude, interdisciplinary research efforts like the ones presented in this dissertation and a continued improvement of prevention opportunities will serve to further our understanding of adolescent depression. It is the hope of the author that in the future this kind of knowledge may aid to decrease the burden of depression for each affected adolescent as well as for society.

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