



Improving Our Understanding of Impaired Social Problem-Solving in Children and Adolescents with Conduct Problems: Implications for Cognitive Behavioral Therapy

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Accepted: 15 December 2021 / Published online: 14 February 2022

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Abstract

In cognitive behavioral therapy (CBT) children and adolescents with conduct problems learn social problem-solving skills that enable them to behave in more independent and situation appropriate ways. Empirical studies on psychological functions show that the effectiveness of CBT may be further improved by putting more emphasis on (1) recognition of the type of social situations that are problematic, (2) recognition of facial expressions in view of initiating social problem-solving, (3) effortful emotion regulation and emotion awareness, (4) behavioral inhibition and working memory, (5) interpretation of the social problem, (6) affective empathy, (7) generation of appropriate solutions, (8) outcome expectations and moral beliefs, and (9) decision-making. To improve effectiveness, CBT could be tailored to the individual child's or adolescent's impairments of these psychological functions which may depend on the type of conduct problems and their associated problems.

Keywords Cognitive behavioral therapy · Conduct problems · Problem-solving · Social information processing · Children · Adolescents

Introduction

Children and adolescents with conduct problems in the clinical range either meet criteria of oppositional defiant disorder (ODD) or conduct disorder (CD) according to the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition, *DSM-5*, American Psychiatric Association, 2013) or show symptoms in the clinical range on a standardized measure of psychopathology. Effective psychological treatment of conduct problems is of utmost importance given the range of short- and long-term negative outcomes in adulthood, including crime, substance use disorders, suicide attempts, low educational achievement, anxiety disorders, depressive disorders, manic episode, schizophreniform disorder, and eating disorders (Fergusson et al., 2005; Kim-Cohen et al.,

2003) as well as high costs in terms of service utilization across all three domains of criminal justice, health, and social welfare (Rivenbark et al., 2018).

According to the most recent large meta-analysis on the effectiveness of psychological therapy for children and adolescents treated for mental health problems in the clinical range mean post-treatment effect size (ES, Cohen's *d*) for conduct problems is 0.46 (Weisz et al., 2017). Notably, the mean effect size of psychotherapy for conduct problems in children and adolescents has been shown to decrease over the last 50 years (1963–2016), suggesting that adjustments are needed in some of the approaches that have been followed thus far (Weisz et al., 2019).

The need for modifications may also hold for cognitive behavioral therapy (CBT) with a mean ES of 0.35 as observed in the meta-analysis by McCart et al. (2006). CBT is particularly relevant for children from 7 years on and for adolescents as this psychological treatment provides them with anger-regulation and social problem-solving skills that enable them to behave in more independent and situation appropriate ways. Anger management and problem-solving are core elements of evidence-based practice for children with conduct problems (Garland et al., 2008). Early CBT programs such as the Anger Control Program (Lochman

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et al., 1981) and Problem-Solving Skills Training (Kazdin et al., 1987) were developed as sole interventions for children with conduct problems. Over the years, developers of programs have combined CBT with other psychological treatments in particular with behavioral parent training. For example, Problem-Solving Skills Training is combined with Parent Management Training (Kazdin et al., 1992). The Coping Power program includes a child component and a parent component (Lochman et al., 2008; Wells et al., 2008). The Stop Now and Plan program also consists of several components including a child component and a parent component (Augimeri et al., 2007; Burke & Loeber, 2015). Finally, the Aggression Replacement Training, a CBT for adolescents incorporates network meetings between parents, teachers, friends, social workers, and other care providers (Goldstein et al., 1998). Alternatively, rather than working with youth and parents separately therapists in the Collaborative & Proactive Solutions (CPS) program help youth and parents together to solve problems in a mutually collaborative and proactive fashion (Greene & Winkler, 2019). In the treatment of adolescents, CBT may be used as an add-on to family-based psychotherapy (e.g., Functional Family Therapy; Alexander et al., 2013) or may become part of interventions targeting multiple systems (e.g., Multisystemic Therapy; Henggeler et al., 1999). More examples of evidence-based CBT programs can be found in reviews by Kaminski and Klaußen (2017) and McCart and Sheidow (2016).

Modifications of CBT programs may be needed as most evidence-based CBT programs were developed during the last three decades of the previous century and have been only slightly updated in more recent years. More specifically, results of studies of the last 20 years on heterogeneity of conduct problems have not been incorporated in this update. Conduct problems are heterogeneous in nature. Children and adolescents with conduct problems not only differ in characteristic symptoms (i.e., defiant behavior, angry/irritable mood, aggressive behavior, antisocial behavior, limited prosocial emotions), but also in symptoms of associated conditions (i.e., attention problems, impulsivity, depressive mood, anxiety, substance abuse). Indeed, irritable mood and defiant behavior dimensions of ODD are distinct components of the disorder (Burke et al., 2014; Stringaris & Goodman, 2009a). Irritable mood predicts anxiety and depression, whereas the behavior dimension of ODD predicts CD in adulthood (Stringaris & Goodman, 2009b). With regard to CD, in recent years a lot of attention has been paid to limited prosocial emotions, previously called callous-unemotional (CU) or psychopathic traits, a diagnostic specifier for individuals who meet full criteria for CD. These include lack of empathy, lack of remorse or guilt, shallow or deficient affect, and unconcerned about performance (American Psychiatric Association, 2013). Associations between conduct problems and symptoms of attention-deficit/hyperactivity disorder

(ADHD) are also relevant to consider as ADHD and ODD or CD often co-occur (Angold et al., 1999). This also applies to other disorders associated with CD in adolescence, including substance misuse, depressive disorders, and posttraumatic stress disorder (Fairchild et al., 2019; Scott, 2015). Intellectual disability also is a risk factor for ODD and CD (Scott, 2015). Children and adolescents with both severe conduct problems and elevated CU traits are at risk for more severe and persistent antisocial future outcomes (Frick et al., 2014) and tend to respond less positively to typical interventions provided in mental health and juvenile justice settings (Frick et al., 2014; Hawes et al., 2014).

Results of empirical studies addressing psychological functions that may be relevant for improving CBT in treating conduct problems have not been incorporated in the update of CBT either. In a previous review, we described how the effectiveness of CBT may be improved by paying more attention to a series of psychological functions that have been shown to be impaired in functional neuroimaging studies: (1) anger recognition, (2) the ability to generate situation appropriate solutions to social problems, (3) reinforcement-based decision-making, (4) response inhibition, and (5) affective empathy (Matthys & Schutter, 2021). However, complementary to neuroimaging studies that focus on the structural and functional neuroanatomic correlates, other studies of psychological functions are equally relevant.

The aim of the present non-systematic narrative review is to update our understanding of the psychological functions that need to be targeted in CBT for children and adolescents with conduct problems from a broader perspective not only in terms of the types of studies, but also of the conceptual model of CBT. Therefore, we start by describing the original model of Problem-Solving Therapy developed by D’Zurilla and Goldfried (1971), subsequent elaborations of this CBT-based model (D’Zurilla, 1988), relevant meta-analyses that draw attention to the various components of the model (Bell & D’Zurilla, 2009; Malouff et al., 2007), and the related social information processing (SIP) model described by Dodge in 1986 and later adapted by Crick and Dodge (1994). Our goal is to provide a theoretical framework for improving our understanding of the psychological functions involved in social problem-solving among children and adolescents with conduct problems. The following psychological functions will be discussed (see Table 1 for an overview): (1) recognition of problematic social situations, (2) recognition of facial expressions in view of initiating social problem-solving, (3) effortful emotion regulation and emotion awareness, (4) behavioral inhibition and working memory, (5) interpretation of social problems, (6) affective empathy, (7) generation of appropriate solutions, (8) outcome expectations and moral beliefs, and (9) decision-making. Specific attention is paid to the heterogeneity of conduct problems as the child’s or adolescent’s impairments of these psychological functions

Table 1 What children and adolescents learn in cognitive behavioral therapy

Topic	Psychological function
1	Recognition of problematic social situations Which social situations are problematic for me? This is important to know in view of starting thinking in a situation that might be difficult for me to handle
2	Recognition of facial expressions What do other person's facial expressions tell me about their feelings and about a possible social problem?
3	Emotion awareness and regulation What do I feel myself? And in case my feeling (e.g., anger) is too strong, what can I do to cope with this feeling?
4	Behavioral inhibition and working memory If I have difficulty thinking prior to acting, why not ask my parents or teachers to attend me on this when I'm inclined to respond impulsively?
5	Interpretation of the social problem When I see that someone else has done something bad to me, I shouldn't always think he/she did that on purpose. He/she could also have done it without necessarily wanting it. Besides what the other wants, I also have to think about what his or her thoughts and feelings are
6	Affective empathy When I see another person is in pain, do I also feel something of pain in myself? If I did hurt the other and I feel something of this in myself, then I will stop hurting the other
7	Generating appropriate solutions In a difficult situation I must try to come up with one or more solutions that bring me benefits
8	Outcome expectations and moral beliefs Then, I would do well to think about the short- and long-term consequences for me, for the other person and for our relationship. I have to find out if I am not harming the other person with that solution. Is it morally correct to do that?
9	Decision-making In the end I choose the best solution for both of us

may depend on the type of conduct problems and their associated problems. Thus, in order to increase the effectiveness of CBT, this psychological treatment probably needs to be tailored to the individual child's or adolescent's impairments of these psychological functions.

Social Problem-Solving Model

In 1971, D'Zurilla and Goldfried described a conceptual model of problem-solving. The term problem refers to a specific situation to which a person must respond in order to function effectively in his or her environment. Based on several theorists and investigators, D'Zurilla and Goldfried (1971) divided the problem-solving process into five general stages: (1) general orientation, (2) problem definition and formulation, (3) generation of alternatives, (4) decision-making, and (5) verification.

In the literature, stages 2, 3, and 4 have received the most attention. In this first publication, however, 'general orientation' occupies a crucial place in the model. Indeed, D'Zurilla and Goldfried (1971) state that an individual's orientation in approaching a situation can greatly influence the way he or she will respond to that situation. Specifically, the type of orientation which is likely to encourage independent problem-solving should include the attitude to (1) accept the fact

that problematic situations constitute a normal part of life and that it is possible to cope with most of these situations effectively, (2) recognize problematic situations when they occur, and (3) inhibit the tendency to respond either on the first "impulse" or to "do nothing."

In 1988, D'Zurilla elaborated on the first stage of problem-solving, now called problem orientation, consisting of a set of facilitative problem orientation cognitions. The function of these cognitions is to (1) increase sensitivity to problems and set the occasion for problem-solving activity, (2) focus attention on positive problem-solving behaviors and away from unproductive worries or self-preoccupying thoughts, (3) maximize effort and persistence in the face of obstacles and emotional stress, and (4) minimize disruptive emotional distress. Two meta-analyses of problem-solving therapy showed the moderating role of these problem-solving orientation cognitions in the effectiveness of this psychological treatment.

First, Malouff et al. (2007) conducted a meta-analysis on efficacy of problem-solving therapy in reducing mental and physical health problems in children and adults. Problem-solving therapy was found to be more effective than no treatment, treatment as usual, and attention placebo, but equally effective as another bona fide treatment. In addition, problem-solving therapy was more effective when it included a problem orientation component rather than focusing only

on problem-solving skills. Second, Bell and D’Zurilla (2009) conducted a meta-analysis on efficacy of problem-solving therapy for reducing depressive symptomatology. Problem-solving therapy was found to be more effective than no treatment and support/attention control groups, and equally effective as other psychological therapies and medication treatment. In addition, component analyses indicated that problem-solving therapy was more effective when the treatment included training in a positive problem orientation rather than problem-solving skills only (e.g., problem definition and formulation, generation of alternatives, decision-making). In sum, there seems to be a tendency among clinicians to skip the problem orientation component with an adverse effect on the effectiveness of problem-solving therapy.

As mentioned earlier, problem orientation includes minimizing disruptive emotional distress. Emotional responses may inhibit social problem-solving (D’Zurilla, 1988). For example, a high level of autonomic arousal may cause a narrowing of attention to irrelevant cues, which may disrupt problem-solving thinking (D’Zurilla, 1988), such as in children and adolescents with the ODD symptom cluster angry/irritable mood. By contrast, emotions may also facilitate social problem-solving by recognizing the occurrence of a problem. Social problem-solving starts with the recognition that there is a problem (see general orientation, D’Zurilla & Goldfried, 1971). Problem recognition may be impaired in children and adolescents with conduct problems due to lack of fear (Matthys & Lochman, 2005), such as in those with limited prosocial emotions. Both awareness and control of emotional responses are thus important for effective problem-solving performance (D’Zurilla, 1988).

The SIP model described by Dodge in 1986 and later adapted by Crick and Dodge (1994) is also relevant to be mentioned here. Indeed, much research on social problem-solving in children with aggressive behavior and conduct problems is based on the SIP model. The latter model is derived, among others, from the model described by Goldfried and D’Zurilla (1969) and reformulated by D’Zurilla and Goldfried (1971). In his first model Dodge (1986) conceptualizes social behavior as a function of the child’s processing of a set of social cues. This processing occurs in five steps and include (1) the encoding of social cues, (2) the mental representation and interpretation of those cues, (3) the search of potential behavioral responses, (4) the evaluation and selection of the optimal response, and (5) the enactment of that response. In the second model, Crick and Dodge (1994) added clarification of goals as an additional step, following the mental representation step (i.e., interpretation of cues) and preceding response search process (i.e., response access or construction). Recently, Verhoef et al. (2021) distinguished between children’s automatic and reflective SIP, where the latter is particularly related to

social problem-solving as discussed here. In the forthcoming sections, SIP studies will be discussed insofar as they are relevant for social problem-solving.

Problematic Social Situations

According to Goldfried and D’Zurilla (1969), effective behavior can be defined as a response to a problematic situation which alters the situation in such a way that it is no longer problematical, and at the same time produces a maximum of other positive consequences and a minimum of negative ones. These theorists emphasize the situation specificity of behavior (Dodge et al., 1986). In accordance, Dodge et al. (1985) developed a taxonomy of problematic social situations (TOPS) questionnaire for elementary school-aged children. This is a questionnaire in which the child’s teacher is asked to rate the likelihood of a child responding in an appropriate manner in a specific situation. In their study, Dodge et al. (1985) involved a small sample of socially rejected ($n = 54$) and adaptive ($n = 39$) children, in which six types of situations or problem domains emerged as factors in the analyses: Peer Group Entry, Response to Peer Provocations, Response to Failure, Response to Success, Social Expectations (from peers), and Teacher Expectations.

Matthys et al. (2001) replicated this study in a larger sample. In Study 1, factor structure of TOPS was investigated in a sample of 715 children from regular schools, grades 1 to 6. Four factors appeared to underlie the TOPS scores: 1. Being Disadvantaged consisting of situations in which the child is excluded from the peer group (e.g., when this child finds out that he or she has been left out of the group, game or activity of peers) is identified by peers as being different (e.g., when peers notice that this child is wearing peculiar clothes or walking peculiarly) or is provoked (e.g., when this child is teased by peers); 2. Coping with Competition consisting of situations in which the child fails (e.g., when this child is playing a game with a peer and realizes that the peer is about to win) or is successful (e.g., when this child has won a game against a peer). 3. Social Expectations of Peers consisting of situations in which the child should respond empathically (e.g., when a peer is troubled, worried, or upset and needs comfort from the child) or should respond to a peer’s own empathic response (e.g., when the child is upset and a peer asks him or her how he or she is feeling); 4. Teacher Expectations consisting of situations in which the teacher has established clear norms for the child’s behavior (e.g., when the child is in the classroom with peers and the teacher must leave the room for a short period of time). Because of the high internal consistency of the four factors, the 44 items questionnaire was abbreviated to a TOPS-Short Form (18 items). In Study 2, differences in factor scores between 42 boys with conduct problems and 67 typically

developing boys were tested. Teachers rated the four types of problem situation as more problematic for boys with conduct problems than for matched control boys. Boys with conduct problems also showed individual differences in the number of situational types that were problematic for them. It was concluded that the identification of the specific social context in which the child with conduct problems displays his or her inappropriate behavior may help refine treatment goals. So, more attention may be given to social functioning in those situations that are specifically problematic for a child or adolescent.

TOPS-Short Form was used to develop the ‘Taxonomy of Problematic Social Situations-Adolescent self-report version’ (TOPS-A) in a sample of 128 adolescents residing in Dutch secure juvenile facilities (Van der Helm et al., 2013). Four factors appeared to underly the TOPS-A scores: situations of Disadvantage, Competition, Accepting Help from and Giving Help to Peers, and Accepting authority from Group Workers. There are certainly more types of problematic social situations than those identified in these questionnaires such as responding to peer pressure (i.e., peers try the child or the adolescent to engage in behaviors in which he or she is not sure to want to engage).

The situation specificity not only of problem behavior but also of social problem-solving has been investigated in two studies. The first study involves school-aged boys with conduct problems, boys with ADHD, and boys with both conduct problems and ADHD (Matthys et al., 1999), and the second study is about adolescents with conduct problems (Van Rest et al., 2020). In both studies, the situation specificity of social problem-solving was demonstrated.

Results of these studies suggest that in CBT more attention needs to be paid to the social situation specificity of both problem behavior and social problem-solving. Therefore, in the clinical assessment of the child or adolescent prior to the start of CBT, the social situations that are problematic for the individual child or adolescent need to be identified (Matthys & Powell, 2018). The psychotherapist explores with the child or adolescent, the parents, and other adults such as teachers or child care workers in day treatment, inpatient treatment, and residential treatment which situations are difficult for the child or the adolescent. Learning to generate appropriate responses, for example, may not be a problem for him or her in all situations but only in specific ones. Thus, the psychotherapist may want to work with the child or the adolescent in those specific situations.

In addition, knowing which particular situations are problematic is important for the child or the adolescent in view of starting the social problem-solving thought process (Table 1: topic 1). In the beginning, the child and the adolescent will need the help of parents, teachers, and other adults who may warn him or her that a difficult situation is coming. The adult’s assistance is important as social problem-solving is

not a natural process for children and adolescents, and perhaps especially not for those with conduct problems. This issue is now discussed in more detail.

Recognition of Facial Expressions

In view of starting the social problem-solving thought process, children and adolescents must be sensitive to social problems and as a result recognize that there is a problem to be solved. We are not aware of any studies on the sensitivity to social problems and related problem recognition. Perhaps, encoding deficits indicate difficulties in recognizing problematic social situations. Boys with conduct problems, for example, have been found to encode less social cues than control boys when shown videos of problematic social situations (Matthys et al., 1999). Becoming aware of a problem seems difficult to investigate empirically. In fact, a direct question that examines whether the child or adolescent recognizes the situation as problematic is inadequate, the issue being whether the child or adolescent spontaneously perceives the situation as problematic (Matthys & Lochman, 2005). Becoming aware of a social problem warrants further research. Psychophysiological measures such as skin conductance and heart rate responses may be candidates to monitor changes in autonomic arousal while children and adolescents watch videos of social situations with different levels of problem severity.

Yet, studies on facial expressions suggest indirect evidence that problem recognition may be difficult for children and adolescents with conduct problems, perhaps in particular for those with lack of prosocial emotions. Facial expressions of others have a communicatory function as they signal relevant information to the observer (Blair, 2003). If displays of fear and sadness are not recognized a potential social problem is ignored and social problem-solving activity is not started. Recognition of fearful and sad facial expressions may be specifically relevant in problem situations when peers expect help and understanding (Dodge et al., 1986; Matthys et al., 2001; Van der Helm et al., 2013). A meta-analysis in children, adolescents, and adults showed a robust link between antisocial behavior and impaired recognition of fearful facial expressions (Marsh & Blair, 2008). Also, boys and girls with disruptive behavior referred to a crime prevention program demonstrated impaired recognition of fear and sadness (Hunnikin et al., 2020).

Recognition of fearful and sad facial expressions has been studied using functional magnetic resonance imaging (fMRI). Threat-related responses are mediated by the amygdala and its connections through hypothalamus to the periaqueductal gray (Blair et al., 2018). Consistent with this, children and adolescents with conduct problems, particularly those with psychopathic or CU traits, show reduced

amygdala responses to fearful expressions (e.g., Jones et al., 2009; Marsh et al., 2008; Viding et al., 2012; White et al., 2012) and sad expressions (Passamonti et al., 2010).

Recognition of other people's anger expressions is also important for recognizing problematic social situations. Displays of anger are important signals to modulate current behavioral responding (Blair, 2003). Other people's angry expressions may be specifically relevant when children or adolescents are being disadvantaged or need to cope with competition (Dodge et al., 1986; Matthys et al., 2001; Van der Helm et al., 2013). Several studies have shown impaired anger recognition in children and adolescents with conduct problems. Boys and girls with disruptive behavior referred to a crime prevention program were impaired in anger recognition (Hunnikin et al., 2020). Likewise, anger recognition was disproportionately impaired in boys with early-onset CD (Fairchild et al., 2009). Also, both boys and girls with conduct problems compared to controls showed more difficulties in recognizing facial emotions including anger (Kohls et al., 2020). Interestingly, compared to matched controls, male young offenders showed reduced recognition of low-intensity anger, but increased recognition of high-intensity anger in others. Additionally, as engagement in offense severity increased, recognition of low-intensity anger decreased even further. Accordingly, severe offenders may have difficulty understanding the warning signals of anger and adapting their behavior prior to escalation (Bowen et al., 2014).

Neuroimaging studies indicate that difficulties recognizing anger in others may be associated with hyporeactivity of the orbitofrontal and anterior cingulate cortex involved in the processing of angry expressions (Blair et al., 1999). Male adolescents and young adults with conduct problems displayed abnormally reduced brain responses of the amygdala, ventromedial prefrontal cortex, orbitofrontal cortex, and insula when viewing angry versus neutral faces relative to controls (Passamonti et al., 2010). Also, female adolescents with conduct problems demonstrated decreased medial orbitofrontal cortex functioning while viewing angry facial expressions (Fairchild et al., 2014).

Emotion recognition in others may be problematic especially in children and adolescents with conduct problems and CU traits. A previous meta-analysis including adults with psychopathy, as well as children and adolescents with psychopathic traits or CU traits, showed pervasive emotion recognition deficits (including fear, sadness, and anger) for facial and vocal expressions (Dawel et al., 2012).

In children and adolescents with conduct problems and co-occurring ADHD, encoding deficits may underly difficulty recognizing problematic social situations. Children with ADHD indeed tend to encode fewer social cues than control children (Andrade et al., 2012; Matthys et al., 1999). These encoding deficits seem to be related to inattention (Ferretti et al., 2019). It has also been shown that attention

problems mediate relationships between executive functions and social outcomes in children with ADHD (Hilton et al., 2017). In addition, children with ADHD have problems with emotion recognition (Ferretti et al., 2019) which may result in problems in recognizing social situations as being problematic.

In conclusion, recognition of facial expressions is crucial for initiating the thought process of social problem-solving. If displays of fear, sadness, and anger are not recognized a potential social problem is ignored and social problem-solving activity is not started. However, recognizing that there may be a social problem is also needed in situations where the other person shows no emotions. Therefore, it is important for the child or adolescent with conduct problems to learn identifying situations that are typically problematic for him or her.

In terms of psychological treatment, recognition of other people's emotions as part of identifying problematic social situations should be a target of CBT (Table 1: topic 2). Children referred to a brief intervention program to prevent anti-social outcomes and who showed impairments in emotion recognition improved significantly in recognition of sadness, fear, anger, and neutral facial expressions (Hunnikin et al., 2020). This study shows that improving recognition of other people's emotions is feasible. We suggest that in CBT emotion recognition is linked to acknowledging that there is a social problem to be solved, a learning process which is not easy for children and adolescents with conduct problems, especially in those with limited prosocial emotions. Therefore, adults including parents, teachers, and child care workers in day treatment, inpatient treatment, and residential treatment are also involved in CBT to assist the child or the adolescent in acquiring this challenging skill in everyday life. Adults need to assist the child or adolescent to recognize other people's emotions, acknowledge that there is a problem in their interaction with a peer or an adult, and that thinking before acting is preferred.

Effortful Emotion Regulation and Emotion Awareness

D'Zurilla (1988) recognized the importance of adequate emotion regulation for successful problem-solving performance. In particular, he specified that emotional distress may be a significant factor affecting problem-solving performance and treatment therefore should include training in various facilitative coping skills, including cognitive restructuring (e.g., reappraisal of threat, correcting misconceptions), self-instruction (e.g., focus attention on task relevant cues and on beliefs and expectations that are likely to facilitate problem-solving performance), and relaxation techniques (e.g., use of relaxation breaks).

In children and adolescents with conduct problems, emotional dysregulation may manifest as irritability. An irritable mood dimension has been identified specifically in ODD and is uniquely associated with concurrent and subsequent internalizing problems such as anxiety and depression (Burke et al., 2014; Stringaris & Goodman, 2009a, 2009b). Thus, emotional dysregulation may be relevant specifically for children and adolescents diagnosed with ODD with or without the presence of anxiety and depression. However, as the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition, *DSM-5*, American Psychiatric Association, 2013) states that ODD may be comorbid with CD, the present section is also relevant for children and adolescents with CD and ODD comorbidity, especially those with the angry/irritable mood symptom cluster according to the *DSM-5* or the chronic irritability-anger subtype of ODD according to the *International Classification of Diseases* (eleventh edition; *ICD-11*, World Health Association, 2020) (see also Evans et al., 2021).

The neural correlates of effortful emotion-regulation strategies such as cognitive reappraisal have been studied using functional neuroimaging. Specifically, the mediation hypothesis of emotion regulation suggests that emotion regulation is achieved by prefrontal–subcortical interactions (Ochsner et al., 2012). Thus, emotion regulation may include both (1) the activation of brain regions associated with cognitive control mechanisms, attention, and response inhibition and (2) the modulation (downregulation) of affective regions (Raschle et al., 2019).

Raschle et al. (2019) studied effortful emotion regulation by cognitive reappraisal in female adolescents with conduct problems and typically developing adolescents. Individuals in both groups were successful in regulating their emotions evoked by negative emotional pictures, but adolescents with conduct problems were less successful than typically developing adolescents. In line with prior evidence (Ochsner et al., 2012), lower activation in left dorsolateral prefrontal cortex and angular gyrus was found in adolescents with conduct problems compared with typically developing adolescents during effortful emotion regulation (Raschle et al., 2019). Also, connectivity between left dorsolateral prefrontal cortex and the bilateral putamen, right prefrontal cortex and amygdala was reduced in the conduct problems group in comparison to typically developing adolescents during cognitive reappraisal. The study showed reduced prefrontal brain activity and functional connectivity during effortful emotion regulation in female adolescents with conduct problems (Raschle et al., 2019). This study also suggests that improving effortful emotion regulation through cognitive reappraisal in adolescents with conduct problems should be an important topic in CBT for conduct problems. Impaired emotion regulation has not only been found in girls but also in boys with conduct problems (Kohls et al., 2020.)

Prior to the regulation of emotions, individuals need to be aware of their emotions to begin with. In the study by Raschle et al. (2019), female adolescents with conduct problems before reinterpreting the scenes observed reported lower scores for emotion reactivity (i.e., a measure of emotion awareness) than controls. There were, however, no differences in brain activation associated with emotion reactivity between both groups. On the other hand, when participants were asked to judge their own emotional reactions to fearful and angry expressions of others, reduced left anterior insula and inferior frontal gyrus responses have been observed in male adolescents with conduct problems and CU traits relative to normal controls (Klapwijk et al., 2016).

Emotion awareness requires perceiving one's internal bodily state, a process called interoception, and conceptualizing it in terms of an emotion label that best unites the current context with past experience (Weissman et al., 2020). Difficulties in assigning emotional labels to negative affect may disrupt effective emotion regulation (Weissman et al., 2020). For this, Weismann et al. refer to a study by Barrett et al. (2001) in which they hypothesized that emotion differentiation and emotion regulation would be positively related in the context of intense experience of negative emotions, where the need for emotion regulation is generally greatest. The ability to differentiate between negative and positive emotions was assessed in typically developing participants' using a 14-day diary protocol. Participants' regulation of negative and positive emotions was assessed using laboratory measures. As predicted, negative emotion differentiation was positively related to the frequency of negative emotion regulation, particularly at higher levels of emotional intensity. Based on these findings, Weissman et al. (2020) conclude that difficulties understanding what one is feeling may disrupt effective emotion regulation.

In CBT, improving children's and adolescents' emotion-regulating abilities, especially with regard to anger, is an important topic (Table 1: topic 3). Children and adolescents first learn to identify physiological cues of anger (e.g., feeling hot, faster heart rate, tightened muscles) as well as various levels of anger (e.g., irritated, mad, furious) with the use of an anger thermometer (e.g., Lochman et al., 2008). Thus, emotion awareness that includes interoception is a topic in CBT. In line with suggestions made by D'Zurilla (1988), children and adolescents then learn to use coping self-statements, distraction techniques, and brief deep-breathing relaxation methods to handle the arousal associated with anger (e.g., Lochman et al., 2008).

Still, one may wonder whether only a few sessions of CBT with the child or adolescent with conduct problems are sufficient to improve emotion awareness of anger and the regulation of anger appropriately in everyday life situations given the previously discussed impairments. Therefore, we

suggest that adults including parents, teachers, and child care workers in day treatment, inpatient treatment, and residential treatment are also involved in CBT to assist the child or the adolescent in acquiring these challenging skills in everyday life. Parents and other adults can observe the child or the adolescent and therapist working on the recognition of physiological cues which signal that the child or adolescents is becoming angry. Parents and other adults can also acquire skills in prompting and praising the child or the adolescent in using an anger thermometer, cognitive reappraisal, and distraction techniques, as well as brief deep-breathing relaxation methods as a means to handle arousal associated with anger.

Behavioral Inhibition and Working Memory

According to D’Zurilla and Goldfried (1971), inhibiting the tendency to respond on the first “impulse” is part of an individual’s orientation in approaching a problematic social situation. In other words, adequate behavioral inhibition is a precondition for appropriate social problem-solving activity. Behavioral inhibition belongs to the executive functions, a set of three interrelated cognitive skills that regulate our thoughts and behavior: 1. Inhibitory control including behavioral inhibition and interference control (selective attention and cognitive inhibition); 2. Working memory; 3. Cognitive flexibility (Diamond, 2013).

While impaired behavioral inhibition is not to be expected in children and adolescents with conduct problems as impulsivity is a typical characteristic of ADHD and not of ODD or CD, the latter disorders and ADHD often co-occur (Angold et al., 1999). Deficits in behavioral inhibition have not only been found in elementary school children with ADHD, but also in children with conduct problems without comorbid ADHD (Oosterlaan et al., 1998). Similarly, impairments in behavioral inhibition have been observed for both preschool children with ADHD and preschool children with ODD or CD with and without ADHD comorbidity relative to typically developing children (Schoemaker et al., 2012). However, a meta-analysis of studies in children and adolescents with ODD, CD, and/or ADHD, and typically developing controls showed that while children and adolescents with ODD or CD have more difficulties with behavioral inhibition than control children, this may be due to ADHD symptomatology in each group (Bonham et al., 2021). Even if this is the case, given the co-occurrence of ADHD symptoms and conduct problems at a greater than random rate (Waschbusch, 2002), impaired behavioral inhibition is still a relevant issue for the conduct problems group.

A recent meta-analysis of whole-brain fMRI studies on five neurocognitive domains revealed that, in comparison to typically developing controls, individuals (mean age

19 years) with conduct/antisocial problems to disorder exhibited reduced activation in premotor cortex, anterior insula, ventrolateral prefrontal cortex, and cerebellar regions during cognitive control tasks (Dugré et al., 2020). These brain regions are key areas involved in cognitive control. Interestingly, according to the authors, results of their study suggest that individuals with conduct/antisocial problems not only display deficits in motor inhibition (right ventrolateral prefrontal cortex), but the inhibitory failures are also not processed as being affectively and motivationally significant (anterior insula), which may result in difficulties in learning from response-inhibition mistakes (Dugré et al., 2020). Reduced anterior insula activation during response inhibition has been observed in children and adolescents with conduct problems, and correlated to ADHD symptoms (Hwang et al., 2016).

With regard to social problem-solving, impaired behavioral inhibition can prevent children and adolescents with conduct problems from starting the thinking process before acting, especially those with either comorbid ADHD or associated ADHD symptoms. Although thinking prior to acting is addressed in CBT, the issue of actually starting the thinking process when children and adolescents are facing a problematic social situation in everyday life at home and at school needs more attention. We therefore suggest that CBT therapists instruct parents, child care workers, and teachers to assist the child or adolescent in withstanding his or her impulsive urges by engaging into the thinking process of social problem-solving that children and adolescents learn in CBT (Table 1: topic 4).

Working memory refers to holding information in mind and mentally working with it (i.e., working with information no longer perceptually present) (Diamond, 2013). Working memory involves a central executive and two storage systems, a phonological (or verbal) and a (visuo)spatial; the two storage systems or components are coordinated and controlled by the central executive (Baddeley, 2003). Working memory deficits have been found in children and adolescents with ADHD and have resulted in attempts to improve working memory through training programs (Kofler et al., 2018, 2020). In a meta-analysis of executive functions in children and adolescents with ADHD, six of eight studies found a significant group difference in spatial working memory. Additionally, significant group differences were reported by 6 out of 11 studies that administered a verbal working memory task (Willcutt et al., 2005). In preschool children, the correlation effect size for working memory deficits and ODD/CD symptoms ($ES_{zr} = 0.15$) was similar to the correlation effect size for working memory deficits and ADHD symptoms ($ES_{zr} = 0.17$) (Schoemaker et al., 2013). In sum, working memory is a relevant psychological function in conduct problems, either because of its association with ODD/CD symptoms or associated ADHD (symptoms).

Working memory may be relevant for social problem-solving in children and adolescents with conduct problems. First, working memory may affect interpretation as interpretation involves assembling multiple pieces of potentially contradictory information. Impaired working memory has been found to be related to hostile interpretations in adolescents with mild to borderline intellectual disability and aggressive behavior (Van Rest et al., 2019). Second, working memory may affect response generation as the incorporation of retrieved information from long-term memory into the current circumstances is required. Impaired working memory has been found to be related to aggressive response generation in adolescents with mild to borderline intellectual disability and aggressive behavior (Van Rest et al., 2019).

Importantly, working memory and behavioral inhibitory control support one another (Diamond, 2013). Working memory may indeed support inhibitory control when, for example, individuals concentrate on the information they are holding in mind they decrease the likelihood of an inhibitory error (Diamond, 2013). Likewise, inhibitory control helps keeping irrelevant information out from working memory (Diamond, 2013). While training programs targeting working memory and inhibitory control (or behavioral/response inhibition) have been less successful than initially anticipated, results of recent studies on central executive training targeting working memory, with effects on response inhibition and hyperactivity, are nonetheless promising (Kofler et al., 2018, 2020). It may be that lack of success of previous training programs is due to their focus on the storage systems of working memory rather than on the central executive (Kofler et al., 2018, 2020). Interestingly, while central executive training targeting working memory had an effect on behavioral/response inhibition, effect of training of inhibitory control on behavioral/response inhibition was inconclusive (Kofler et al., 2020). These findings are in line with the hypothesis that inhibition deficits in ADHD are secondary to underlying impairments in working memory (Kofler et al., 2020).

We therefore suggest that executive function training programs such as central executive training are included in the treatment of children and adolescents with conduct problems and ADHD. In addition, in a review of interventions and approaches for improving executive functions, Diamond and Ling (2016) hypothesize that while challenging of executive functions is necessary for improving them, benefits of improving executive functions will be greater if children's and adolescents' emotional, social, and physical needs are also addressed. For instance, stress, sadness, loneliness, not enough sleep, and lack of physical activity have a negative impact on executive functioning (Diamond & Ling, 2016). Parents can therefore create conditions (e.g., healthy life style) for their child to make optimal use of their executive functions among working memory and behavioral inhibition.

Interpretation of the Social Problem

According to D'Zurilla and Goldfried (1971), the first step following the general orientation phase in social problem-solving is problem definition and formulation, here called interpretation of the social problem. In children and adolescents with aggressive and antisocial behavior, the interpretation of the social problem has largely been studied from the perspective of the accuracy of the child's attributions about the motives for others' actions. Hostile attribution biases or the tendency to attribute hostile intent to peers in social situations with a negative outcome have been demonstrated in rejected children, aggressive children, and children and adolescents with conduct problems (Crick & Dodge, 1994). A first meta-analysis of these studies demonstrated a correlation effect size of $r = 0.17$ (Fisher Z) (transformed into Cohen's $d = 0.35$) between hostile intent attribution and aggressive behavior in children (De Castro et al., 2002). In a second meta-analysis, the correlation effect size was $d = 0.33$ (Verhoef et al., 2019). This hostile-attributional bias in boys with aggressive behavior has been demonstrated to be increased by feelings of threat (Dodge & Somberg, 1987). According to social-cognitive theory, the tendency to attribute hostile intentions to others derives from transactions between aversive child experiences, such as harsh parenting and peer rejection on the one hand, and child susceptibility to such experiences on the other hand (Dodge et al., 1995; Lansford et al., 2010).

Other social-cognitive processes are involved in interpretation as well, such as perspective-taking. Children with externalizing symptomatology have more immature abilities in perspective-taking in comparison with children with internalizing symptomatology (Cohen et al., 1985). Also, the free person description method has been used in which the child is asked via an open instruction to give a written description of another child. This method investigates the child's intention to attend to certain information. Boys with conduct problems when compared with typically developing boys, just as younger boys when compared with older ones, have been found to perceive their peers more in relation to themselves (i.e., from an egocentric point of view) and to pay less attention to their peers' inner, personal worlds. Instead, in their free person descriptions they attend more to the peers' external qualities, specifically to the peers' activities with others. In other words, boys with conduct problems when compared with typically developing boys were more action oriented and less inclined to pay attention to their peers' inner features such as their thoughts, emotions, and intentions (Matthys et al., 1995).

Interestingly, a fMRI study showed that when antisocial adolescents performed a game, they took the intention of

the other player less into account and this was associated with less activation in the temporal parietal junction, a brain area involved in the understanding of intentions and thinking about others (Van den Bos et al., 2014). According to the authors, results support the hypothesis that in social interactions antisocial adolescents do not have the tendency to take the social context fully into account. The authors conclude that this is in line with studies that suggest that perspective-taking skills are not necessarily deficient in these adolescents, but they may not spontaneously engage them. In another study with criminal justice involved boys with conduct problems the neural mechanisms underlying fairness decisions in response to communicated emotions of others were examined (Klapwijk et al., 2016). Results showed that the boys with conduct problems compared with typically developing boys had less activity in the right temporal parietal junction and supramarginal gyrus when receiving happy compared with disappointed and angry reactions. According to the authors decreased activation in these brain areas in the conduct problems group might suggest that boys with conduct problems were less inclined to take the perspective of the other person during happy compared with angry and disappointed reactions. As discussed above, in their free person descriptions, boys with conduct problems also spontaneously attended less to their peer's inner, personal worlds (Matthys et al., 1995).

This might relate to difficulties in mentalizing which is the capacity to understand others and oneself in terms of intentional mental states, such as feelings, desires, wishes, attitudes, and goals (Luyten et al., 2020). Mentalizing is a transdiagnostic concept implicated in a wide range of psychological problems including antisocial personality disorder and its precursor in childhood and adolescence, CD (Luyten et al., 2020). The ability for mentalizing is acquired in the context of attachment relationships (Luyten et al., 2020). Attachment insecurity has been shown to be related to conduct problems. According to a meta-analysis, the average effect size for the contrast between secure and insecure children and externalizing behavior was significant ($d=0.31$); in clinical samples, the average effect size amounted to $d=0.49$ (Fearon et al., 2010). Difficulties in interpreting other people's intentions and feelings in insecurely attached children and adolescents with conduct problems may be related to mentalizing deficiencies.

Improving children's social-cognitive abilities has long been a target of prevention of antisocial and aggressive behavior (Table 1: topic 5). The Fast Track study showed that a multiyear preventive intervention offered at schools including not only the promotion of children's social-cognitive and social skills (PATHS curriculum, Greenberg et al., 2011; Friendship Groups, Bierman et al., 2017) but also the improvement of parenting skills and academic mentoring

(Conduct Problems Prevention Research Group, 2020) resulted in a decrease of antisocial behavior. This reduction was mediated by its impact on three social-cognitive processes: (1) Reducing hostile-attribution biases, (2) increasing the generation of socially competent responses to social problems, and (3) devaluing aggression (Dodge et al., 2013). This study not only demonstrates that changing hostile-attributional biases is feasible, but is also a mechanism of change and as such constitutes an important aspect of cognitive-behavioral-oriented treatment approaches. It should be noted that the changes in hostile attributions were achieved not only by influencing children's cognitions, but also their social skills, and by working with parents on their parenting skills, and all this over several years. Thus, the learning processes to change interpretations by children and adolescents with conduct problems need to be intensive and lengthy, though we do not know for how long. Of course CBT cannot be expected to last for years, but the intensity of treatment may be increased by involving parents, child care workers, and teachers in CBT in view of allowing the learning processes to take place in everyday life. After termination of CBT, parents and teachers must continue to support the child's and adolescent's learning processes.

Affective Empathy

Empathy is the understanding of another's emotional state (cognitive empathy) as well as the ability of sharing/feeling another's emotional state (affective empathy). The cognitive aspect involves finding out or inferring and understanding another person's emotional state (e.g., sadness, fear, or pain). The affective aspect includes the emotional response to ourselves in perceiving the other person's feeling. In particular, this emotional response is appropriate to or congruent with another's situation than to one's own (Eisenberg & Fabes, 1990; Hoffman, 1984; Moul et al., 2018). Here, we define affective empathy as the emotional component of the interpretation of the social problem.

Empathy is associated with prosocial behavior such as helping and comforting others and contributes to the inhibition of antisocial and aggressive behavior (Eisenberg & Miller, 1987; Miller & Eisenberg, 1988). However, systematic and meta-analytic reviews of empathy show considerable inconsistencies in the assumed association between empathy and conduct problems. Differences in the measures used and the conceptualization of empathy have been suggested to, at least in part, contribute to the heterogeneous findings (Moul et al., 2018). Lack of empathy is among the key features of CU traits (Frick et al., 2014) or limited prosocial emotions (*DSM-5*; American Psychiatric Association, 2013).

Blair (1995) suggested that in humans a victim's pain and distress induces similar feelings of distress in the aggressor, which in turn stops further aggressive behavior. Children and adolescents with a deficit in this mechanism will be less likely to learn to avoid harming other individuals, because the distress of other individuals is less aversive for them. These children and adolescents are therefore more likely to continue displaying behaviors that harm others to achieve their goals.

Functional MRI studies support this view. Adolescents with conduct problems and psychopathic traits, including reduced empathy and guilt, showed reduced activity in regions associated with empathic pain as the depicted pain increased: the rostral anterior cingulate cortex, ventral striatum, and amygdala (Marsh et al., 2013). In another study, reduced activity in the insula while viewing others being harmed was related to children's greater CD symptoms and callousness (Michalska et al., 2016).

Studying facial mimicry and heart rate is also relevant here. Facial mimicry is a component in the process of affective empathy. In normal persons, exposure to sadness is associated with heart rate deceleration. Adolescents with conduct problems and high CU traits showed less facial responsiveness (corrugator EMG activity) and less heart rate change from baseline during exposure to empathy-inducing film clips portraying sadness than controls (De Wied et al., 2012). Impairments in affective empathy have also been demonstrated in adolescents with conduct problems without CU traits (Martin-Key et al., 2017).

Difficulties in affective empathy related to pain and distress of others can result in the maintenance of aggressive behavior. Currently, in CBT, attention is given to better understand the emotions of others, but whereas cognitive empathy is a theme, affective empathy is not. Here, we suggest that improving affective empathetic responding, in particular in response to other's pain and distress, should be a target in CBT. Children and adolescents with conduct problems, especially those with limited prosocial emotions, must learn to pay attention to the child's distress towards whom they start displaying aggressive behavior and must experience themselves how it feels like if this is done to them, with a view to stopping this behavior (Table 1: topic 6). This requires a lot of practice, perhaps adding virtual reality, as individuals tend to respond realistically to virtual simulations of real-life events (Dellazizzo et al., 2019), to everyday life situations. Parents, child care workers in day treatment, inpatient treatment, and residential treatment, and teachers can learn how to help the child or adolescent in paying attention to peer's distress when the child or adolescent starts showing behavior that physically and/or mentally harms others.

Generating Appropriate Solutions

According to D'Zurilla and Goldfried (1971), the step following problem definition and formulation, here called interpretation, is the generation of alternatives, here termed generating appropriate solutions. Only few studies have focused on the quantity and the quality of the solutions generated by children and adolescents with conduct problems. As for the number of solutions, boys with conduct problems have been found to generate fewer solutions to problems in videos than their peers in situations in which they have to cope with competition (Matthys et al., 1999). Boys with a CD diagnosis produced more aggressive and antisocial solutions in response to stories about conflicts with parents and teachers, and fewer verbal and non-aggressive solutions in response to stories about peer conflicts, in comparison to boys with ODD (Dunn et al., 1997). Likewise, adolescents with conduct problems generated more aggressive responses than their typically developing peers in response to videos about clearly accidental situations (Van Rest et al., 2020). Aggressive children also offered fewer verbal assertive solutions in vignettes about peer conflicts than their non-aggressive peers (Lochman & Lampron, 1986). For treatment purposes the latter finding is highly relevant, that is if children and adolescents with conduct problems have only limited appropriate responses in their repertoire, how to strengthen their ability to generate appropriate solutions to social problems?

When individuals demonstrate problems with the processing of reward cues as shown in children and adolescents with conduct problems (Matthys et al., 2012, 2013), they are less able to make accurate predictions about which kind of behaviors is beneficial for them (Blair, 2010). Reduced reward processing can impair social problem-solving, in particular the generation of solutions that are beneficial for them, a topic that may have been underestimated in SIP research.

When looking at the brain, the amygdala is thought to be implicated in the formation of stimulus-outcome associations based on environmental feedback, and closely interacts with the orbitofrontal cortex, which is implicated in the generation of reinforcement-related expectations (Averbeck & Costa, 2017; Costa & Averbeck, 2020; Rolls, 2004). The orbitofrontal cortex and striatum also play a role in error prediction during learning (Hare et al., 2008; O'Doherty et al., 2006). In a situation where the individual is opting for whether or not to make a response associated with a particular value, reinforcement expectancy information provided by the striatum on the basis of prior experience is critical (Blair et al., 2018). The striatum and anterior cingulate cortex are also important for prediction

of error signals (i.e., detecting a discrepancy between the anticipated and actual outcome). Prediction error signals are thought to facilitate reward and punishment-related feedback learning in terms of error minimization routines. In addition, the ventromedial prefrontal cortex and orbitofrontal cortex represent reinforcement expectancies (Blair et al., 2018; Finger et al., 2011). Children and adolescents with conduct problems have been found to show reduced responses in the orbitofrontal cortex, ventromedial prefrontal cortex, anterior cingulate cortex, and striatum during anticipation of rewards (Finger et al., 2011; Hawes et al., 2021; White et al., 2013). Also, reduced activation in the dorsal anterior cingulate cortex was found in children with conduct problems compared with typically developing children when anticipating rewards and suggests issues with integrating reward-related target detection with value encoding to facilitate attention allocation and guide behavior (Hawes et al., 2021).

These studies suggest that difficulties in making correct predictions about which behavior in a certain situation is most beneficial can interfere with children's and adolescents' ability to generate situation appropriate solutions to social problems. As a result, at least a subgroup of children and adolescents with conduct problems will show no adequate solutions in their cognitive repertoire. In CBT, children and adolescents are encouraged to come up with as many solutions as possible which then are categorized into solution types such as help seeking, verbal assertion, compromise, verbal aggression, and physical aggression. One may question whether CBT therapists should work on this with children and adolescents independently of parents and teachers. Children's learning to generate appropriate solutions is likely to be a slow process, require a lot of practice, and must therefore also take place in everyday life situations (in vivo practice, Kazdin et al., 1989). We already referred to the Fast Track study, the multiyear preventive intervention offered at schools, resulting in a decrease of antisocial behavior. This reduction was mediated by its impact on three social-cognitive processes among which increasing the generation of socially competent responses to social problems (Dodge et al., 2013). This study thus demonstrates that increasing children's generation of appropriate responses to social problems is feasible, but is also a mechanism of change and as such constitutes an important aspect of cognitive-behavioral-oriented treatment approaches.

In order to strengthen children's and adolescents' ability to produce solutions, CBT therapists may teach parents, child care workers, and teachers how to assist the child or the adolescent to come up with solutions that are beneficial for him or her well-being (e.g., solutions resulting in a better relationship with parents, siblings, and peers) (Table 1: topic 7). As a complement, collaborative discussions with parents may teach children how to generate mutually satisfactory

solutions. This approach, called Collaborative & Proactive Solutions (CPS) (Greene & Winkler, 2019), focuses on helping children and parents learn to proactively solve daily social problems. In a clinical trial in youth with ODD, the Collaborative & Proactive Solutions program was shown to be equivalent to a behavioral parent training program (Ollendick et al., 2016).

Children and adolescents should also experience for themselves that socially appropriate solutions are rewarding, so that they can become part of their cognitive repertoire. Therefore, in families where coercive interactions prevail over positive interactions between the child or adolescent and his or her parents and siblings, CBT therapists in their work with parents teach them how to elicit appropriate behaviors in their child by giving positive instructions as well as by relabeling problem behavior in its positive opposite and giving this opposite as an instruction (Kazdin, 2005). If these appropriate behaviors produce a rewarding effect on the child or the adolescent, these behaviors are more likely to re-occur in comparable situations and consequently have a higher likelihood that they become part of their behavioral repertoire for dealing with social situations effectively. As a result, these solutions are stored in long-term memory and become part of their cognitive repertoire in dealing with social situations.

Outcome Expectations and Moral Beliefs About Aggression

According to Crick and Dodge's model (1994), after the generation of responses, the responses are evaluated based on outcome expectations (i.e., children's ideas about what is likely to occur in a social interaction after the enactment of a behavioral response) and normative or moral beliefs (i.e., children's standards about the acceptability or non-acceptability of a behavior) (Huesmann & Guerra, 1997). Children and adolescents with aggressive behavior expect aggressive behavior to lead to favorable outcomes for they have learned that aggression reduces aversive treatment by other people (see principle of negative reinforcement and Patterson's Coercive Theory, 1982). For example, it was shown that aggressive children are more confident that aggression will produce tangible rewards and will reduce aversive treatment by others compared to non-aggressive children (Perry et al., 1986). With regard to normative beliefs, positive evaluation of aggressive behavior, including social acceptability and moral appropriateness of aggression, incremented the prediction from externalizing behavior in early adolescence to later antisocial problems (Fontaine et al., 2002). Moreover, a stronger belief that aggressive retaliation is acceptable predicted more aggressive behavior in children 2 years later (Zelli et al., 1999). There is also evidence that atypical

outcome expectations and normative or moral beliefs are related to CU traits. In a study with adjudicated youth, higher CU traits were related to increased expectations and values associated with the positive consequences of aggression (i.e., tangible rewards, dominance) and decreased expectations and values associated with the negative consequences of deviant behavior (i.e., punishment) (Pardini et al., 2003).

In this type of research little consideration is given to the role of emotion in moral thinking and reasoning (Blair, 2017). This changed in the 1990s when neurocognitive studies were conducted in psychopathy to infer the core role of emotion in moral development (Blair, 1995). Typically, developing individuals are predisposed to find the distress of others' aversive and learn to avoid actions associated with this distress (i.e., acts that harms others) (Blair, 1995). Care-based morality refers to those forms of moral reasoning that concerns actions that harm others (Blair, 2007). Stimulus-reinforcement learning allows healthy individuals to learn the valence of a stimulus (Blair, 2017). In particular, Blair (2017) argues that the sense of badness of care-based moral transgressions is because representations of these transgressions have been associated with an aversive unconditioned stimulus, that is the distress of the other individual. Thus, typically individuals learn to avoid actions associated with another individual's distress. Impairments in stimulus-reinforcement learning and in responsiveness to the distress of other individuals, reliant on the integrity of the amygdala, disrupt individual's ability to learn the emotion-based sense of badness of care-based moral transgressions (Blair, 2017).

The neural circuitry underlying stimulus-reinforcement learning includes the amygdala where information about the conditioned stimulus and unconditioned stimulus converge (Blair, 2017). Failure of aversive conditioning in young children is a risk for later aggressive behavior in childhood and antisocial behavior in adulthood. Poor electrodermal fear conditioning in young children has been shown to be a risk factor for later aggressive behavior and criminality. In a prospective study, fear conditioning using electrodermal responsivity was assessed in children aged 3, 4, 5, 6, and 8. It was shown that poor fear conditioning from ages 3 to 8 years is associated with aggression at age 8 (Gao et al., 2010a). Furthermore, it appeared that poor fear conditioning at age 3 predisposes an individual to crime at age 23 (Gao et al., 2010b). In a recent study of electrodermal fear conditioning, poor fear conditioning in 11-year old children was shown to be associated with high levels of self-report CU traits (Chen et al., 2021).

The amygdala plays a role in care-based moral judgments (Blair, 2007). Reduced amygdala responsiveness to the distress of other individuals has been shown in children and adolescents with conduct problems and CU traits (Marsh et al., 2008). In addition to the amygdala, other regions that are involved in stimulus-reinforcement learning include the

hippocampus, ventromedial prefrontal cortex, and the dorsal anterior cingulate cortex (Blair, 2017). Care-based judgments rely, first, on the amygdala associating the aversive emotional response to the victim's distress with the representation of the action that caused this distress, and, second, on the ventromedial prefrontal cortex representing the value of the transgression (Blair, 2007). In line with this, adolescents with conduct problems and psychopathic traits showed reduced amygdala activity and reduced amygdala-orbitofrontal cortex functional connectivity when making judgments about legal/illegal actions. In particular, psychopathic traits appear to be associated with these adolescents' inability to attach the appropriate valence to actions of varying moral permissibility (Marsh et al., 2011).

Findings on outcome expectations and moral beliefs in children and adolescents with conduct problems suggest that these should be topics in CBT, especially in children and adolescents with limited prosocial emotions (Table 1: topic 8). After children and adolescents have come up with solutions, the therapist asks questions about the consequences of these solutions and about the moral acceptability of the solutions: 'What do you think will happen if you do or say that? Will that help solve the problem? What is the direct effect for yourself and for the other? And what is the effect in a week or a month? Do I not harm the other person with this solution? Is it morally permissible to do that?' Since positive outcome expectations of aggression arise from experiences that aggressive behavior pays off (see negative reinforcement, Patterson, 1982), parents, child care workers, and teachers also need to work on the child's or adolescent's behavioral repertoire (see "Generating appropriate solutions" section). Children and adolescents should experience for themselves that socially appropriate behaviors are also and even more rewarding. Through this associative learning process, they will develop positive outcome expectations about these behaviors.

Decision-Making

According to D'Zurilla and Goldfried (1971), the step following generation of alternatives (here called generating appropriate solutions) is decision-making. In the Crick and Dodge (1994) model, this step is called response selection.

As compared to typically developing boys, school-aged boys with conduct problems who were given the opportunity to select a response among a number of options shown in videos, including prosocial responses, more often selected an aggressive response and less frequently a prosocial response in situations in which they are being disadvantaged (Matthys et al., 1999). Likewise, adolescents with conduct problems more often selected an aggressive response among the various response options shown in videos as compared

with their typically developing peers in accidental situations (i.e., situations in which they are being disadvantaged by accident) (Van Rest et al., 2020). It is interesting to note that children and adolescents with conduct problems even after an extensive assessment of the social information process in which examples of appropriate responses are shown and numerous questions about the various responses asked are still inclined to select an aggressive response (Van Rest et al., 2020). Finally, to select a generated behavioral response for enactment, children must first feel confident that they can produce the behavior, a process called self-efficacy evaluation (Crick & Dodge, 1994). Both children and adolescents with conduct problems felt more confident than their typically developing peers to enact an aggressive response, independent of the type of social problem situation (Matthys et al., 1999; Van Rest et al., 2020).

Difficulties in decision-making based on uncertainties about positive and negative outcomes can impede children's and adolescents' ability to make decisions about appropriate solutions to social problems. In neurobiological research, reinforcement-based decision-making studies show that reduced neural responsiveness to reward puts an individual at risk of poor decision-making because response choices are less guided by expectations that an action will result in reward relative to punishment (Blair et al., 2018). A meta-analysis of whole-brain fMRI studies showed that the most consistent dysfunction in children and adolescents with conduct problems involves the rostro-dorsomedial, fronto-cingulate, and ventral-striatal regions that mediate reward-based decision-making (Alegria et al., 2016). In addition, the anterior insular cortex, dorsomedial frontal cortex, and caudate nucleus of the striatum have been found to be implicated in avoidance-related behavior (Blair et al., 2018). Dysfunctions in these regions when making suboptimal choices as a function of expected value have been found in adolescents with conduct problems (White et al., 2014) and are correlated to increased risk for antisocial behavior (White et al., 2016).

In CBT, after discussing outcome expectations and moral beliefs, the child or the adolescent needs to make a decision. However, whether just discussing outcome expectations and moral beliefs is sufficient to change children's and adolescents' decision-making process remains an open question. Here, we suggest two approaches that may facilitate the learning processes involved in making appropriate decisions in everyday life situations. First, children and adolescents with conduct problems need to actually experience that appropriate behaviors result in positive consequences. Likewise, they only will believe or feel confident that they can successfully perform appropriate behaviors through multiple experiences. Therefore, therapists in their work with parents and other adults teach them how to elicit and then reinforce appropriate responses in the child or adolescent. Second,

therapists teach parents and other adults how they can assist the child or the adolescent in evaluating various responses and selecting the response for enactment that is most appropriate for him or her not only on the short term (e.g., in terms of reaching a goal for the child or the adolescent himself or herself), but also on the long term (e.g., in terms of positive consequences for the relationship with the other person) (Table 1: topic 9). Parents and other adults can learn to ask the child or the adolescent questions such as those previously mentioned. Children and adolescents with conduct problems, however, may have difficulties in making appropriate decisions because response choices are less guided by expectations that an action will result in reward relative to punishment. Therapists therefore remind parents, child care workers, and teachers that much repetition is needed to improve the child's or adolescent's decision-making.

Discussion

In view of increasing the effectiveness of CBT for the treatment of conduct problems in children and adolescents, we aimed to update our understanding of the psychological functions that may be targeted in CBT of conduct problems starting from the CBT model developed by D'Zurilla and Goldfried (1971) and the related SIP model by Crick and Dodge (1994). For this, we have used results from empirical studies on these psychological functions and on the heterogeneous nature of conduct problems, and paid more attention than hitherto to starting up the social problem-solving thought process. The initiation of social problem-solving activity may be hampered by a lack of recognition of the other individual's facial expression that points to a potential social problem. Indeed, if displays of fear, sadness, and anger in others are not recognized, a potential social problem is ignored and social problem-solving activity is not started. This may be specifically problematic for children and adolescents with limited prosocial emotions (Dawel et al., 2012). Likewise, impulsivity as a result of impaired behavioral inhibition can prevent children and adolescents with conduct problems from starting the thinking process, especially in those comorbid with ADHD or with associated ADHD symptoms (Bonham et al., 2021). On the other hand, knowing which social situations are problematic can help children and adolescents starting the social problem-solving thought process. Children's and adolescent's understanding of problematic social situations has received little attention so far while both inappropriate behavior and problem-solving are dependent on the type of social problem (Matthys et al., 1999, 2001; Van Rest et al., 2020).

Attention was also given to the disruption of the thought process by emotional distress, specifically in children and adolescents with the angry/irritable mood symptom cluster

of ODD and/or anxiety and depression comorbidity. Studies on effortful emotion regulation by cognitive reappraisal and on emotion awareness of anger are limited, but suggest difficulties that may require more than working on these in CBT sessions only. We therefore suggest that CBT therapists teach parents, child care workers, and teachers how to assist the child or the adolescent in acquiring these challenging skills in everyday life.

Similarly, studies show deficiencies in the interpretation of problematic social situations, affective empathy, generating appropriate solutions, thinking in terms of outcome expectations and moral reasoning, and decision-making. Although the multiyear preventive intervention Fast Track study has shown that several psychological functions can actually improve and result in a decrease of antisocial behavior, we do not yet know how much time is needed to achieve these improvements neither how comprehensive and intensive the learning processes targeted are needed (Conduct Problems Prevention Research Group, 2020). With regard to the latter, Fast Track included the PATHS curriculum (Greenberg et al., 2011) presenting lessons two or three times per week targeting both social skills and social problem-solving skills. In addition, high-risk aggressive children were invited to attend Friendship Groups and Peer Pairing to promote the generalization of the new skills to the school setting (Conduct Problems Prevention Research Group, 2020). The Fast Track study thus supports the notion that CBT not only must target cognitions (the C component) but behaviors as well (the B component), and that *in vivo* practice is part of the treatment. Therefore, we propose that working on the psychological abilities only during a limited number of sessions is not sufficient. Children's and adolescents' use of these psychological abilities in everyday life on the other hand must be elicited, supported, and reinforced by parents, teachers, and child care workers, the latter in case of day treatment, inpatient treatment, and residential treatment. So, these adults must actively participate in the CBT of the child and the adolescent, and especially find ways, with the help of the therapist, to make use of the learning processes of which the first steps were taken in the sessions in everyday life.

Furthermore, several other psychological functions may need additional attention. We suggest that executive function training programs such as central executive training are included in the treatment of children and adolescents with conduct problems and ADHD (Kofler et al., 2020). Likewise, in view of enhancing their affective empathic response use of virtual reality may help children and adolescents with conduct problems and limited prosocial emotions to learn paying attention to the other child's distress towards whom they start displaying aggressive behavior in order to stop this behavior.

CBT arguably needs to be tailored to the child's and adolescent's characteristic impairments of the psychological functions targeted in CBT. Therefore, in the clinical assessment preceding CBT, the therapist explores with the parents and the child or adolescent both the specificity of the problematic social situations and the psychological functions that need to be targeted. However, before starting a psychological treatment for conduct problems these need to be recognized. Authoritative clinical researchers have repeatedly pointed to the tendency to ignore, underrecognize, and undiagnose ODD and CD (Fairchild et al., 2019; Kim-Cohen et al., 2003), perhaps due to misconceptions that they do not constitute a mental disorder but are instead reflective of bad behavior (Burt et al., 2018). The present review underlines that ODD and CD, and conduct problems with a clinical level, are not essentially different from other disorders in childhood such as ADHD.

CBT is not offered as the only psychological treatment for conduct problems but is typically added to behavioral parent training, family therapy, or systems therapy. It may be thought that adding CBT to these psychological treatments could have a negative effect on the willingness of families to start treatment because of the increase in effort and burden of the family. Engaging families in psychological treatment for conduct problems indeed is challenging (Acri et al., 2018). Data from 262 studies for example showed that at least 25% of the parents of children aged 2 to 12 years identified as appropriate for behavioral parent training do not start treatment, and an additional 26% of the parents begins, but drops out before completing treatment (Chacko et al., 2016). But when behavioral parent training is the only psychological therapy suggested by the clinician parents may not start treatment because they think that their parenting skills are already of a sufficient level and their child has to deal with his or her problems. So, involving the child or adolescent himself or herself in the treatment (i.e., CBT) in order to improve his or her social problem-solving skills may increase the likelihood that the treatment will start or be completed. This may also hold true for family therapy and systems therapy. Alternatively, in the Collaborative & Proactive Solutions (CPS) program (Greene & Winkler, 2019) therapists work with children or adolescents and parents together from the start on. This can prevent dropout compared to the combination of CBT with behavioral parent training, family therapy, or systems therapy.

In view of tailoring CBT to the child's and adolescent's characteristic impairments of the psychological functions, a modular approach as first used in CBT for anxiety disorders and subsequently for other types of psychopathology may be appropriate here (Chorpita et al., 2004; Evans et al., 2020). A modular approach preserves the benefits of standardization of manualized protocols, while, at the same time, modules can be flexibly arranged so that the

content, order, and dose are adjusted to the child and adolescent characteristics. Thus, standard modules may be developed for core social problem-solving skills: initiating social problem-solving activity including the recognition of other people's emotions, interpretation of the social situation, generation of appropriate solutions, and decision-making. In view of specific impairments, additional modules may be developed for emotion awareness and emotion regulation, behavioral inhibition and working memory (e.g., central executive training), affective empathy, and outcome expectations and moral reasoning. When several children or adolescents can be treated at the same time in the outpatient, inpatient, or residential treatment setting, modules can be offered in group format. Group format is engaging for children and adolescents and offers many opportunities for modeling and practicing.

Further research is needed to support the hypotheses that improving the psychological functions will contribute to larger therapeutic effects in terms of a decrease of conduct problems and increase of adaptive behaviors. Also, more studies are needed in girls with conduct problems, in ODD, and in emotion awareness and emotion regulation.

Conclusion

Starting from a theoretical model of CBT, the present review of empirical studies addressed nine psychological functions that may be targeted in CBT of children and adolescents with conduct problems. Our non-systematic narrative review suggests that, first, a number of psychological functions may need more attention than hitherto given (e.g., recognizing facial expressions in view of starting social problem-solving activity, affective empathy). Second, CBT needs to be tailored to the individual child's or adolescent's impairments of these psychological functions which may depend on the type of conduct problems (e.g., limited prosocial emotions, angry/irritable mood symptom cluster) and associated problems (e.g., ADHD symptoms). Third, parents and other adults need to elicit, support, and reinforce the child's or adolescent's use of these psychological functions in everyday life (in vivo practice).

Funding This work was supported by an NWO (Dutch Research Foundation) Innovational Research Grant VI.C.181.005 (D.S).

Declarations

Conflict of interest The authors have no competing interests to declare.

Ethical Approval Not applicable.

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