Received: 4 September 2023 | Revised: 12 June 2024 | Accepted: 15 June 2024

DOI: 10.1002/ab.22162

RESEARCH ARTICLE

AGGRESSIVE BEHAVIOR WILEY

Approach-avoidance tendencies in proactive and reactive aggression

Bram Van Bockstaele[1,2,3]

[1]Research Institute of Child Development and Education, University of Amsterdam, Amsterdam, the Netherlands

[2]Centre for the Advancement of Research on Emotion, School of Psychological Science, University of Western Australia, Perth, Australia

[3]Department of Developmental, Personality, and Social Psychology, Ghent University, Ghent, Belgium

Correspondence
Bram Van Bockstaele, Department of Developmental, Personality, and Social Psychology, Ghent University, Henri Dunantlaan 2, 9000 Gent, Belgium.
Email: Bram.Vanbockstaele@gmail.com and Bram.Vanbockstaele@UGent.be

Funding information
Fonds Wetenschappelijk Onderzoek; FWO Odysseus project, Grant/Award Number: G0DCB23N

Abstract

Aggressive behaviors have been related to approach/avoidance tendencies. In our current study, we investigated whether approach/avoidance tendencies for angry versus fearful emotional expressions were differentially predictive of children's reactive and proactive aggression. A total of 116 children (58 girls, M_{age} = 10.90, standard deviation SD_{age} = 0.98) completed an approach/avoidance task (AAT) and a stimulus-response compatibility task (SRCT), both measuring the extent to which they tended to approach or avoid angry and fearful facial expressions relative to neutral facial expressions. Children also completed a self-report scale of reactive and proactive aggression. Although none of the approach/avoidance tendency scores correlated significantly with either of the aggression scores, stronger approach tendencies for angry faces and stronger avoidance tendencies for fearful faces in the AAT predicted more reactive aggression. Similar yet nonsignificant results were found for proactive aggression, but no effects were replicated in the SRCT. Our results thus invite the conclusion that reactive aggression is characterized by a tendency to approach angry faces and a tendency to avoid fearful faces. However, the poor discrimination between both types of aggression as well as the lack of convergence between the results of our two measures of approach/avoidance tendencies indicates that further research is needed to establish the role of approach/avoidance tendencies for emotional faces as markers for childhood aggression.

KEYWORDS
approach-avoidance tendencies, children, proactive aggression, reactive aggression

1 | INTRODUCTION

Aggressive behaviors are often defined as behaviors directed toward other people with the intent to cause harm (Anderson & Bushman, 2002). Early theories on the development, causes, and underlying mechanisms of aggression saw aggression as a result of hampering peoples' efforts to attain their goals (frustration–aggression theory; see Berkowitz, 1989; Dollard et al., 1939) or as a behavior learned through observation and reinforcement (social learning theory; see Bandura, 1973). More encompassing perspectives, such as the general aggression model (Anderson & Bushman, 2002), see aggression as a result of situational (e.g., provocation, drugs, pain, etc.) and personal factors (e.g., attitudes, values, gender, etc.) that are further mediated by cognitions, emotions, and arousal (for a review, see DeWall et al., 2012).

Aggressive behaviors develop early in childhood. For instance, most infants between 6 and 12 months old use force to tug toys toward them or push people's bodies (for a review, see Hay, 2017). At the same age, children respond differently to aggressors or acts of aggression than to victims or acts of defense. For instance, 10-month-old infants show a behavioral preference for victims over aggressors (Kanakogi et al., 2013; see also Kanakogi et al., 2017), and 8-month-old infants look longer at affiliative agents than at aversive agents (Geraci et al., 2022). Physical acts of aggression are a relatively common phenomenon in preschool children but during later childhood, adolescence, and adulthood, most people learn to control their aggressive impulses (Tremblay, 2010). However, childhood aggression is one of the best predictors of adult criminal behaviors. Children with more conduct problems at age 10 are more often involved in violence at age 21 (Mason et al., 2004), and childhood aggression is the best predictor of the likelihood of being arrested, the frequency of being arrested, the seriousness of committed crimes at age 30 (Huesmann et al., 2002). This developmental pathway of childhood aggression to adulthood violence and crime comes at large costs, both for families and society (Raaijmakers et al., 2011). Cohen and Piquero (2009) estimated the lifetime cost of career criminals between 2.6 and 5.3 million USD, and the annual cost of crime in the US alone is estimated in excess of 4 trillion USD (Anderson, 2021). Research on the causes of and mechanisms behind childhood aggression, with the ultimate goal of preventing criminal behaviors in adulthood, is thus paramount.

Researchers often differentiate between reactive and proactive aggression (Dodge & Coie, 1987). Reactive aggression refers to more impulsive hostile or violent reactions to perceived threats or provocations, with the goal to defend oneself and remove the perceived threat. Proactive aggression is more planned, deliberate, and instrumental, and is used to obtain goals such as money, status, dominance, or power. Whereas children scoring high on reactive aggression experience more emotional problems, anxiety, and social exclusion, children scoring high on proactive aggression engage more in bullying and bossy, coercive behaviors (Polman et al., 2009). Next to these different motives and prognoses, the underlying cognitive mechanisms of reactive and proactive aggressive behaviors may also be different.

According to the influential social information processing theory (Crick & Dodge, 1994), six consecutive steps precede social behaviors. After (1) encoding and (2) interpreting incoming information, children (3) select goals or preferred outcomes, they (4) generate and (5) evaluate different response alternatives, after which (6) they perform the chosen response. Atypical processing in each of these steps could result in aggressive behaviors. Importantly, the theory stipulates that information processing happens largely automatically, and aggressive behavior is thus not necessarily the result of conscious reflection. As such, aggressive behaviors could be the result of automatic or unconscious cognitive processing biases. Similarly, the general aggression model (Anderson & Bushman, 2002) posits that behavior follows from either immediate, automatic appraisals of situations and stimuli, or—if enough resources are available and the immediate appraisal outcome is important and unsatisfying—from more elaborate reappraisals. As in the social information processing theory, automatic or unconscious processes may thus increase the likelihood of aggressive behaviors. One such automatic process that has been argued to influence behaviors is the tendency to approach or avoid people, objects, or situations.

Many motivation theories posit that people will more likely approach than avoid positive or appetitive stimuli, and they will more likely avoid than approach negative or aversive stimuli (e.g., Elliot, 2006; Lang, 1995). As mentioned earlier, infants as young as 10 months old are more likely to reach toward (approach) victims than aggressors (Kanakogi et al., 2013). Exaggerated patterns of approach/avoidance preferences have been related to several forms of psychopathology, such as addictions and phobias (for a recent review, see Fricke & Vogel, 2020). For instance, Field et al. (2008) found that heavy but not light drinkers were faster to approach than to avoid pictures of alcohol, and the degree to which people were faster to approach than to avoid alcohol was positively correlated with their alcohol consumption and risk of alcohol use disorder. Crucially, research in the addiction domain has shown that exaggerated patterns of approach/avoidance tendencies do not only characterize addictive behaviors, they may also causally contribute to the development or maintenance of addiction (e.g., see Wiers et al., 2011). As such, the extent to which people tend to automatically approach or avoid certain stimuli or situations to a certain extent guides their behavior.

In our present study, we set out to investigate whether individual differences in approach to and avoidance of angry and fearful facial expressions would be related to individual differences in aggression. Previous work has shown that people generally tend to avoid rather than approach angry expressions, and they tend to approach rather than avoid fearful expressions (Marsh et al., 2005). However, Krieglmeyer and Deutsch (2013) found that the general tendency to avoid angry faces was only present if approach was represented as peaceful. If the approach response was represented as aggressive, angry faces facilitated approach rather than avoidance. Krieglmeyer and Deutsch argued that aggressive personality characteristics (among other things) influence whether aggressive approach or avoidance is preferred when encountering angry faces. As such, the extent to which people approach rather than avoid angry faces may reflect their aggressive personality. Given causal relations between approach/avoidance tendencies and behaviors in other fields (e.g., Wiers et al., 2011), a tendency to approach angry faces may result in increased frequencies of confrontations and conflict with angry people, which could in turn increase the frequency of aggressive episodes.

Previous studies relating approach/avoidance tendencies with aggression-related constructs have mostly looked at psychopathic traits. Louise von Borries et al. (2012) used an approach/avoidance task (AAT, Solarz, 1960), in which participants used a joystick to pull or push pictures of happy, neutral, or angry facial expressions either toward or away from them. Whereas healthy controls were faster to avoid than to approach angry faces (i.e., they showed a tendency to avoid angry faces), psychopaths showed no such avoidance of angry faces. Similar findings were also reported by Dapprich et al. (2021),

who found in a student sample that increased levels of psychopathic traits were predictive of reduced avoidance (and thus increased approach) of angry faces (see also Driessen et al., 2021). To our knowledge, Dapprich et al. (2022) were the only ones to not find a positive association between psychopathic traits and a tendency to approach angry faces. However, they used an irrelevant feature version of the AAT, in which participants did not respond based on the emotionality but on the color of the faces, which yields notably unreliable estimates of approach/avoidance tendencies (Kahveci et al., 2023). Similar to findings of research in psychopathy, students scoring higher on trait anger have been found to show stronger approach toward angry faces, whereas people scoring lower on trait anger showed stronger avoidance of angry faces (Veenstra, Schneider, Bushman, et al., 2017). Finally, Derks et al. (2022) recently found that teens diagnosed with conduct disorder showed less avoidance of angry faces than typically developing teens.

Fewer studies have looked at relations between approach/avoidance tendencies and actual aggression. Lobbestael et al. (2016) measured approach/avoidance tendencies toward pictures of angry and neutral faces, but also toward different scenes (attack, neutral, positive, and negative). They found that self-reported reactive aggression was positively associated with a tendency to approach attack scenes and positive scenes, but not angry faces, and proactive aggression was associated with a tendency to avoid attack scenes. However, like Dapprich et al. (2022), they used an irrelevant feature version of the AAT, again yielding unreliable estimates of approach/avoidance tendencies.

The above overview of previous research shows that, in general, healthy individuals avoid angry faces, and people diagnosed with psychopathy, conduct disorder, or high trait anger show reduced avoidance or even approach to angry faces. However, several issues remain to be addressed. First, research on approach/avoidance tendencies in the broad aggression domain has focused almost exclusively on adults (the exception being the study of Derks et al., 2022). Given that childhood aggression is the best predictor of adulthood aggression and crime (Huesmann et al., 2002), the early identification and detection of processes that could drive or contribute to children's aggressive behaviors is paramount, as this could help intervening before the aggressive behaviors spiral out of control. Second, few studies on approach to or avoidance of emotional faces in this context have differentiated between reactive and proactive aggression (the exception being the study of Lobbestael et al., 2016). Angry faces can indeed signal threat or provocation and could therefore prompt approach tendencies in highly reactive aggressive people. However, for people scoring high on proactive aggression, approaching angry faces would not be aligned with their goals. That is, proactively aggressive people by definition use aggression in a planned and deliberate manner to obtain status or assert dominance. To obtain these goals, it would be better to avoid threat and to approach and take advantage of signals of weakness, such as fearful faces.

In our present study, we aimed to fill these gaps in the literature. Using two different measures of approach/avoidance tendencies, we asked 8-to-13-year-old children to either approach or avoid angry, fearful, or neutral faces, after which they self-reported on their reactive and proactive aggression. Given that reactive aggression is defined as a reaction to perceived threats or provocations, we expected that higher levels of reactive aggression would be predicted by a stronger tendency to approach angry but not fearful faces. Inversely, given that proactive aggression is defined as instrumental behavior serving to assert dominance, we expected that higher levels of proactive aggression would be predicted by a stronger tendency to approach fearful but not angry faces.

2 | METHOD

2.1 | Participants

A total of 116 children (58 girls and 58 boys, M_{age} = 10.90, standard deviation SD_{age} = 0.98) who agreed to participate and whose parents had provided written informed consent before the study started the study. A post hoc sensitivity analysis using G*Power (Faul et al., 2007), with conventional values of .80 for power and .05 for α, and two predictors showed that our sample size of 116 was large enough to reveal significant R^2 deviations from zero with effects sizes of f^2 = .085 and larger. According to Cohen (1992), f^2 values of .02, .15, and .35 reflect small, medium, and large effects, respectively. As $f^2 = R^2/(1 - R^2)$, an f^2 value of .085 (i.e., a small to medium effect) corresponds to an R^2 value of .079, meaning that we had enough power for regressions explaining at least 8% of variance in the outcomes. A similar analysis looking at the significance of a single regression coefficient showed that our sample was large enough to detect significant regression coefficients with f^2 values of .05 and larger (i.e., again, a small to medium effect).

2.2 | Materials

We used pictures of facial expressions from the National Institute of Mental Health database (Egger et al., 2011). From this database, we selected eight boys and eight girls, and from each of these children, we used an angry, fearful, and neutral expression, resulting in a total of 48 pictures. For practice blocks and instructions, we used the same expressions from one additional boy and one additional girl, selected from the same database.

2.3 | Questionnaires

Instrument for Proactive and reactive aggression (IRPA; Polman et al., 2009; Rieffe et al., 2016). We used the self-report version of the IRPA developed by Rieffe et al. (2016) to measure reactive and proactive aggression. This scale probes six different aggressive behaviors (kicking, hitting, pushing, name calling, picking fights, and gossiping). For each of these behaviors, children indicated for three reactive motives (because I was mad, because I was bullied, because I

was kicked (/pushed/hit/called names/provoked/being lied about) and three proactive motives (because I wanted to be mean, because I took pleasure in it, because I wanted to be the boss) how often they performed these behaviors in the past 4 weeks on a 5-point Likert scale (1 = *(almost) never*, 5 = *very often*).[1] Both the reactive and proactive subscales showed good internal consistency in our sample, Cronbach's αs = .91 and .90, respectively.

2.4 | Approach avoidance task

We used a relevant feature AAT as a first measure of approach/avoidance tendencies toward angry and fearful faces. In this task, children pulled or pushed pictures of emotional facial expressions toward or away from them. The task consisted of two test blocks, each consisting of 64 trials. On each trial, a picture of either an angry, fearful, or neutral facial expression was displayed in the center of the screen, and depending on the emotional expression of the face, children responded by pressing the down arrow on the keyboard to pull the picture toward them (approach) or the up arrow to push the picture away from them (avoid). Approach and avoidance responses were accompanied by a zoom effect, making approached pictures larger and avoided pictures smaller. In the first test block, children approached emotional faces and avoided neutral faces, and in the second test block, they approached neutral faces and avoided emotional faces. In both test blocks, each emotional face was shown once (i.e., 16 angry and 16 fearful faces), and each neutral face was shown twice (i.e., 32 neutral faces). Faces were selected randomly without replacement. The task measured reaction times starting from the onset of the picture to the completion of the approach/avoidance response. Before each test block, children were given visualized instructions, they completed a 16-trial practice phase with error feedback, and the experimenter answered questions and monitored children's overall understanding of the task instructions. Responses on the practice blocks were not analyzed.

2.5 | Stimulus-response compatibility task (SRCT: De Houwer et al., 2001)

We used a relevant feature SRCT as a second measure of approach/avoidance tendencies toward angry and fearful faces. In this task, children moved a small manikin either toward (approach) or away from (avoid) pictures of emotional facial expressions. This task also consisted of two test blocks, each again consisting of 64 trials. On each trial, a picture of either an angry, fearful, or neutral facial expression was displayed in the center of the screen. A small manikin was presented either above or below the face, and depending on the emotional expression of the face, children used the up or down arrow to move the manikin either toward the face or away from the face. Upon responding, the manikin moved in the direction corresponding with the response. In the first test block, children moved the manikin toward emotional faces and they moved the manikin away from neutral faces, whereas in the second test block, they moved the manikin toward neutral faces and they moved the manikin away from emotional faces. As in the AAT, in both test blocks, each emotional face was shown once (i.e., 16 angry and 16 fearful faces), each neutral face was shown twice (i.e., 32 neutral faces), and faces were selected randomly without replacement. The task measured reaction times starting from the onset of the picture. Before each test block, children were given visualized instructions, they completed a 16-trial practice phase with error feedback, and the experimenter answered questions and monitored children's overall understanding of the task instructions. Responses on the practice blocks were not analyzed.

2.6 | Procedure

Children were recruited from six different primary schools in North Holland. For each participating school, the school principal and the teachers were informed of the goal and procedure of the study before agreeing to participate. About 2 weeks before the testing day, information letters were sent to parents, in which they were given information about the broad study idea, the tasks and procedure, anonymity of the data, as well as their rights to withdraw their children from the study. Only children whose parent(s) had provided active, written informed consent and who indicated that they wanted to participate themselves on the testing days were included in the study. Children were tested in small groups of two to six children, during school hours (dates and times were discussed beforehand with teachers and principals), in separate rooms in the schools. All children first completed the AAT, followed by the SRCT and the IRPA.[2] In both reaction time tasks, children completed each test block at their own pace, but after each test block the experimenter made sure all children had completed the block and they ran through the instructions for the next block in group. The entire procedure took about 30 min and was approved by the ethical committee of the University of Amsterdam (ref. no. 2020-CDE-12910). This study was not preregistered.

2.7 | Scoring, data cleaning, and statistical approach

For both the AAT and the SRCT, we followed the preprocessing and scoring guidelines of Kahveci et al. (2023). Although these guidelines concern the AAT only, we considered it best to use the same criteria and procedures also for the SRCT. The AAT data of one child were set missing because this child responded close to chance level (i.e., 54.69% correct), indicating that they did not understand or failed to comply with task instructions. We then calculated error percentages, and we set task data missing if error rates were larger than the group mean plus three *SD*s, indicating that they performed poorly on the task relative to their peers. For the AAT, this resulted in the loss of two participants (group M = 94.00% correct, SD = 4.37, both participants' scores = 80.47%), and for the SRCT, this also resulted in the loss of two participants (group M = 92.87% correct, SD = 6.56, participants'

scores = 62.50% and 66.41%). Next, we removed errors (AAT: 833/14,464 trials, 5.76%; SRCT: 967/14,592 trials, 6.63%), and for each individual child, we removed *trials* with disproportionately fast or slow reaction times (RTs) relative to their individual median response latency (AAT: 1343/13,631 trials, 9.85%; SRCT: 1415/13,625 trials, 10.39%) following the median absolute deviation approach with a moderately conservative threshold of 2.5 described by Leys et al. (2013). From the remaining trials, we calculated double-difference *D*-scores for angry and fearful faces separately, using the following formula (with emotion indicating either angry or fearful, respectively):

[(*M* RT avoid emotion − *M* RT approach emotion) − (*M* RT avoid neutral − *M* RT approach neutral)]/(*SD* of all trials used in the calculation of the numerator).

Large positive scores indicate an increased tendency to approach rather than avoid angry/fearful faces relative to neutral faces, whereas large negative scores indicate a tendency to avoid rather than approach angry/fearful faces relative to neutral faces. To estimate the reliability of the obtained scores, we calculated Spearman–Brown corrected means of 6000 random split-half correlations, using the AAT Tools R-package (Kahveci, 2020). This procedure yielded the following reliability estimates and 95% confidence intervals: AAT angry faces: 0.67, [0.57, 0.75]; AAT fearful faces: 0.67, [0.57, 0.75]; SRCT angry faces: 0.56, [0.43, 0.66]; SRCT fearful faces: 0.53, [0.40, 0.64].

To answer our main research questions, we tested two separate path models, predicting reactive and proactive aggression from either the AAT-based or the SRCT-based approach/avoidance tendency *D*-scores for angry and fearful faces. We used standardized scores for all variables. Because regression-based approaches can be influenced considerably by cases with extreme scores, we first ran preliminary multivariate regression analyses to identify cases that diverged disproportionately from the rest of the sample based on design-specific cut-offs for leverage (i.e., $3 \times (k + 1)/n$, where k = the number of predictors and n = sample size) following the best-practice recommendations of Aguinis et al. (2013). Next, we flagged and removed these disproportionately outlying cases (three cases in the AAT analysis, zero cases in the SRCT analysis), and we tested the path models without them.[3]

3 | RESULTS

3.1 | Descriptive statistics and correlations

Table 1 provides the descriptive statistics of the study's main variables, as well as the correlations between them. Age was negatively correlated with reactive aggression. We found a large and significant positive correlation between reactive and proactive aggression, indicating that both types of aggression co-occur in children. None of the approach/avoidance tendency scores for either angry or fearful faces correlated significantly with either of the aggression scores. Within tasks, approach/avoidance tendency for angry faces correlated positively with approach/avoidance tendency scores for fearful faces. Finally, demonstrating modest levels of convergent validity, the approach/avoidance tendency score for angry faces in the AAT correlated positively with the same score in the SRCT, as did the approach/avoidance tendency score for fearful faces in the AAT and the SRCT. Independent samples t-tests comparing boys and girls on all the study variables revealed no significant gender differences on any of the approach/avoidance tendency scores, all *ts* < 1, all *ps* > .39. Boys tended to score higher on both forms of aggression (reactive: *M* = 11.22, SD = 10.58; proactive: *M* = 4.16, *SD* = 8.19) than girls (reactive: *M* = 7.66, *SD* = 8.95; proactive: *M* = 1.90, *SD* = 4.09), but neither of the gender comparisons was statistically significant, both *ts* < 1.97, both *ps* > .05.

3.2 | Path models predicting reactive and proactive aggression from approach/avoidance tendencies

In two separate path models, we tested whether approach/avoidance tendencies for angry and fearful faces in the AAT (Figure 1, top) or the SRCT (Figure 1, bottom) predicted children's self-reported reactive and proactive aggression. Neither of the models included gender or age. Both path models were saturated, implying that the model fit was perfect and that only the parameter estimates and not the overall model fit can be meaningfully interpreted. In the AAT

TABLE 1 Descriptive statistics of and correlations between the study variables.

	N	*M*	*SD*	2.	3.	4.	5.	6.	7.
1. Age	115	10.896	0.977	−.214*	−.096	.020	.068	−.035	.098
2. Reactive aggression	116	9.440	9.917		.545**	.050	−.103	.015	.032
3. Proactive aggression	116	3.026	6.547			.055	−.028	−.072	−.074
4. AAT D-AB angry	113	0.001	0.792				.755**	.238*	.168
5. AAT D-AB fearful	113	−0.039	0.794					.222*	.219*
6. SRCT D-AB angry	114	0.024	0.687						.717**
7. SRCT D-AB fearful	114	−0.091	0.680						

Note: Correlations are Spearman's *ρ*.

Abbreviations: AAT, approach/avoidance task; D-AB, double-difference *D*-score approach/avoidance tendency; SRCT, stimulus-response compatibility task.

*$p < .05$; **$p < .01$.

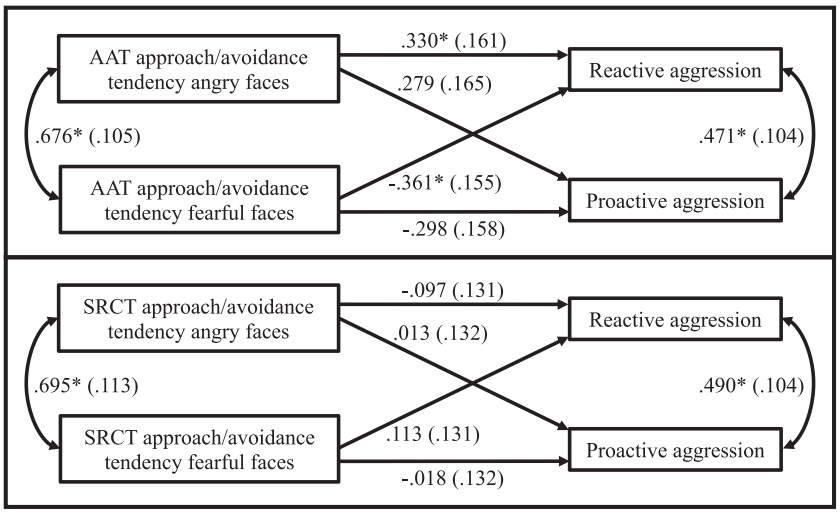

FIGURE 1 Path models predicting reactive and proactive aggression from AAT-based (top) or SRCT-based (bottom) approach/avoidance tendency *D*-scores. AAT, approach/avoidance task; SRCT, stimulus-response compatibility task.

model, after removing three disproportionally outlying cases, we found that reactive aggression was predicted by a stronger approach tendency toward angry faces as well as by a stronger avoidance tendency of fearful faces. For proactive aggression, the pattern was similar but neither of the path coefficients were statistically significant.[4] In the SRCT model, in which no cases were identified as disproportionally outlying, approach/avoidance tendencies for both angry and fearful faces were unrelated to both reactive and proactive aggression. As such, although we found that reactive aggression is characterized by stronger tendencies to approach angry facial expressions and stronger tendencies to avoid fearful facial expressions as measured with the AAT, we found no evidence for our hypothesis that proactive aggression would be characterized by stronger approach tendencies toward fearful expressions, and we failed to replicate the above effect in the SRCT.

4 | DISCUSSION

In this study, we investigated whether approach/avoidance tendencies for angry versus fearful faces would be differentially predictive of reactive versus proactive aggression in children. On a correlational level, none of the approach/avoidance tendency scores were significantly related to either of the aggression scores. Partially in line with our hypothesis, we found that children who had a stronger tendency to approach angry faces and a stronger tendency to avoid fearful faces in the AAT had higher levels of reactive aggression. Contrary to our hypothesis, higher levels of proactive aggression were not predicted by a stronger tendency to approach fearful faces. If anything, like reactive aggression, proactive aggression tended to be associated with stronger tendencies to approach angry faces and to avoid fearful faces in the AAT, although neither of these effects was statistically significant. Finally, this pattern of results from the AAT was not replicated in the analyses of the SRCT, where no effects approached statistical significance.

Our finding of approach to angry faces and avoidance of fearful faces in the AAT being predictive of reactive aggression aligns to a certain extent with the social information processing theory (Crick & Dodge, 1994) and general aggression model (Anderson & Bushman, 2002), in that we show that aggressive behaviors can be predicted by indices of relatively automatic information processing. Although approach/avoidance tendencies are not explicitly part of either of the above models/theories, such tendencies have been shown to be predictive of many pathological behaviors (Fricke & Vogel, 2020). Our present findings suggest that reactive aggression is characterized by the extent to which approach/avoidance tendencies in the presence of people expressing anger or fear are activated.

The increased approach to angry faces and avoidance of fearful faces in the AAT being predictive of reactive aggression is also largely in line with the definition of reactive aggression as an aggressive reaction to perceived threat. Children who tend to approach angry peers would more often end up in conflict situations and would thus demonstrate more aggressive reactions than children who tend to avoid angry peers. Although this conclusion is tempting, we want to stress that this effect was only significant in the AAT and not in the SRCT, and that the tendency to approach angry faces only predicted reactive aggression in combination with the tendency to avoid fearful faces (i.e., the simple correlation between the approach tendency for angry faces and reactive aggression was not significant). The divergence between the findings from the AAT and the SRCT could in part be explained by the overall poor convergence between the two measures. Although both measures have been used to measure approach/avoidance tendencies, correlations between them are—as they were in our study—typically relatively small (e.g., see Basanovic et al., 2023), indicating that the underlying constructs of both tasks do not fully overlap. Given these inconsistencies, we interpret our present result as indicative but not definitive.

Our findings for proactive aggression were—if anything—opposite to our original hypothesis: We found no evidence for our hypothesis that children who would approach fearful faces (i.e., easy targets to assert dominance over) would be the ones scoring higher on proactive aggression. The relatively strong correlation between proactive and reactive aggression indicates that, at least in 8-to-

13-year-old children, both types of aggression co-occur (see also Polman et al., 2007). Although no relations between approach/avoidance tendencies and proactive aggression were statistically significant, the direction and size of effects was similar rather than opposite to the effects that we found for reactive aggression. Our findings thus present no evidence to support the idea that different cognitive processes may underly both types of aggression (e.g., see Lobbestael et al., 2016). Although it would be important to replicate our findings using an aggression measure in which proactive and reactive motives are uncorrelated (e.g., Polman et al., 2009), van Dijk et al. (2021) found that clear differentiations between subtypes of aggression do not necessarily imply clear differences in constructs that are arguably uniquely related to either proactive or reactive aggression. It is thus possible that approach/avoidance tendencies for emotional facial expressions do not differentiate between both types of aggression, and that aggression in general is characterized by a tendency to approach angry faces (see Krieglmeyer & Deutsch, 2013) as well as a tendency to avoid fearful faces.

Our study is the first to relate approach/avoidance tendencies for different emotional faces with reactive and proactive aggression in children. Our combined results of the tendency to approach angry faces and the tendency to avoid fearful faces in the AAT being predictive of both reactive and proactive aggression are not in line with previous research in adults. The only study that to our knowledge related approach/avoidance tendencies for emotional faces with reactive and proactive aggression found that neither reactive nor proactive aggression was related with the tendency to approach/avoid angry faces (Lobbestael et al., 2016). However, their study used a less reliable irrelevant feature version of the AAT. The reliability estimates in our present study varied between .53 and .56 for the SRCT and were .67 for the AAT, which is relatively standard for relevant feature AATs (Kahveci et al., 2023). The lower reliability of the SRCT may in part account for the divergence between the AAT and SRCT results, and the AAT thus seems more suitable to reliably measure approach/avoidance tendencies in children.

Given the fact that childhood aggression is the best predictor of adulthood delinquency, research on the potential determinants of aggression in children also has clinical and societal relevance. As our study does not allow for causal conclusions, it would be a crucial next step to experimentally induce different patterns of approach/avoidance toward angry and fearful faces and assess the impact of these changes on children's aggression levels. Prior studies have shown that experimentally induced changes in approach/avoidance tendencies for alcohol, achieved by training participants to avoid alcohol-related stimuli, can significantly reduce relapse rates of alcohol-dependent patients (Wiers et al., 2011; for a recent review, see Loijen et al., 2020). Analogously, our findings could suggest that training aggressive children to avoid angry faces and approach neutral and fearful faces may lead to clinically significant reduced levels of aggression. Supporting this idea, Veenstra, Schneider, and Koole (2017) found that undergraduate students who were trained to avoid angry faces showed decreased anger and aggressive impulses relative to students who were trained to approach angry faces.

Our study also has limitations. First, we only assessed aggression through self-report. We told children that their responses would not be shared with anyone, but it is possible that some children were reluctant to be honest about their aggressive behaviors. Although the instrument that we used is validated for use in children, research shows that children's self-reported levels of reactive and proactive aggression are only weaky related to teachers' reports of children's reactive and proactive aggression (Rieffe et al., 2016). Adopting a multi-informant design, including self-reports as well as teacher reports and potentially naturalistic observations may prove more suitable to comprehensibly measure aggression in children. Second, we measured only approach/avoidance tendencies toward generic emotional faces. Unlike the study of Lobbestael et al. (2016), we did not include negative or attack-related scenes, nor did we include faces with different emotions (e.g., laughing faces, which could be interpreted as making fun of someone). Also, it could be that children show different approach/avoidance tendencies for known faces (e.g., the school bully). Future studies could include more varied stimulus materials, and potentially even use personalized stimulus sets, using pictures of facial expressions of children's classmates.

These limitations notwithstanding, we found that children's approach to angry faces and their avoidance of fearful faces as measured with the AAT was predictive of their reactive aggression. We found similar effects for proactive aggression, but for both types of aggression, we could not replicate these findings in the SRCT. Approach/avoidance tendencies for emotional faces may thus constitute a marker for childhood aggression, but further research and replication is needed.

AUTHOR CONTRIBUTIONS

Bram Van Bockstaele: Conceptualization; methodology; software; investigation; data curation; formal analysis; writing—original draft; writing—review and editing.

ACKNOWLEDGMENTS

The author thanks Isabella van Biemen and Menno Groen for their aid in the data collection. Bram Van Bockstaele currently works as a postdoctoral research fellow at Ghent University, funded by the FWO Odysseus project G0DCB23N, awarded to Peter Prinzie.

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

DATA AVAILABILITY STATEMENT

The raw data, detailed outlier analysis description, transformed data, and the analysis output are available on the following OSF-page: https://osf.io/t52gh/.

ORCID

Bram Van Bockstaele http://orcid.org/0000-0002-5860-6449

ENDNOTES

[1] Note that this version of the IRPA differs from the original version (Polman et al., 2009), in which first the frequency of an aggressive behavior is probed, followed by questions about the motives of the behavior if it was present.

[2] Upon finishing the IRPA, children also completed an unvalidated Dutch translation of the State-Trait Anger Expression Inventory for children and adolescent (STAXI-CA: del Barrio et al., 2004). This instrument was included for exploratory purposes and is not discussed in the current manuscript. Interested readers can find the STAXI-CA scores in the data file stored in the OSF repository of our study.

[3] In/exclusion of these disproportionally outlying cases had limited impact on the overall pattern of results. The online supplement contains the detailed output of the analyses of the entire sample (Supporting Information S1: Figure S1), and we explicitly mention in the main results if and how results from the full sample analysis deviated from the sample excluding these disproportionately outlying cases.

[4] In the full sample analysis, the path between AAT approach/avoidance tendency for fearful faces and proactive aggression just reached statistical significance, see Supporting Information.

REFERENCES

Aguinis, H., Gottfredson, R. K., & Joo, H. (2013). Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods*, *16*(2), 270–301. https://doi.org/10.1177/1094428112470848

Anderson, C. A., & Bushman, B. J. (2002). Human aggression. *Annual Review of Psychology*, *53*, 27–51. https://doi.org/10.1146/annurev.psych.53.100901.135231

Anderson, D. A. (2021). The aggregate cost of crime in the United States. *The Journal of Law and Economics*, *64*(4), 857–885. https://doi.org/10.1086/715713

Bandura, A. (1973). *Aggression: A social learning analysis*. Prentice-Hall.

Basanovic, J., Dondzilo, L., Rudaizky, D., & Van Bockstaele, B. (2023). Reliability and convergence of approach/avoidance bias assessment tasks in the food consumption domain. *Quarterly Journal of Experimental Psychology*, *76*(5), 968–978. https://doi.org/10.1177/17470218221108270

Berkowitz, L. (1989). Frustration-aggression hypothesis: Examination and reformulation. *Psychological Bulletin*, *106*(1), 59–73. https://doi.org/10.1037/0033-2909.106.1.59

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*, *115*(1), 74–101. https://doi.org/10.1037/0033-2909.115.1.74

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Cohen, M. A., & Piquero, A. R. (2009). New evidence on the monetary value of saving a high risk youth. *Journal of Quantitative Criminology*, *25*, 25–49. https://doi.org/10.1007/s10940-008-9057-3

Dapprich, A. L., Gilboa-Schechtman, E., Becker, E. S., & Rinck, M. (2022). Evaluations of three different types of smiles in relation to social anxiety and psychopathic traits. *Cognition and Emotion*, *36*(3), 535–545. https://doi.org/10.1080/02699931.2021.2016638

Dapprich, A. L., Lange, W.-G., von Borries, A. K. L., Volman, I., Figner, B., & Roelofs, K. (2021). The role of psychopathic traits, social anxiety and cortisol in social approach avoidance tendencies. *Psychoneuroendocrinology*, *128*, 105207. https://doi.org/10.1016/j.psyneuen.2021.105207

De Houwer, J., Crombez, G., Baeyens, F., & Hermans, D. (2001). On the generality of the affective Simon effect. *Cognition & Emotion*, *15*(2), 189–206. https://doi.org/10.1080/02699930125883

del Barrio, V., Aluja, A., & Spielberger, C. (2004). Anger assessment with the STAXI-CA: psychometric properties of a new instrument for children and adolescents. *Personality and Individual Differences*, *37*(2), 227–244. https://doi.org/10.1016/j.paid.2003.08.014

Derks, L. M., Becker, E. S., Rinck, M., Holtmann, M., & Legenbauer, T. (2022). I C U but I don't care: Callous-unemotional traits and approach-avoidance behaviour in conduct disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *76*, 101743. https://doi.org/10.1016/j.jbtep.2022.101743

DeWall, C. N., Anderson, C. A., & Bushman, B. J. (2012). Aggression. In I. Weiner (Ed.), *Handbook of psychology* (Vol. 5, 2nd ed., pp. 449–466).; H. Tennen, J. Suls, (Eds.), *Personality and social psychology*. Wiley. https://doi.org/10.1002/9781118133880.hop205021

Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology*, *53*(6), 1146–1158. https://doi.org/10.1037//0022-3514.53.6.1146

Dollard, J., Doob, L., Miller, N., Mowrer, Q., & Sears, R. (1939). *Frustration and aggression*. Yale University Press.

Driessen, J. M. A., Brazil, I. A., Lorenzo, E. D., Herwaarden, A. E., Olthaar, A. J., Potamianou, H., & Glennon, J. C. (2021). Psychopathic traits influence threat avoidance in a community sample independent of testosterone. *Personality Disorders: Theory, Research, and Treatment*, *12*(5), 428–436. https://doi.org/10.1037/per0000481

Egger, H. L., Pine, D. S., Nelson, E., Leibenluft, E., Ernst, M., Towbin, K. E., & Angold, A. (2011). The NIMH Child Emotional Faces Picture Set (NIMH-ChEFS): A new set of children's facial emotion stimuli. *International Journal of Methods in Psychiatric Research*, *20*(3), 145–156. https://doi.org/10.1002/mpr.343

Elliot, A. J. (2006). The hierarchical model of approach-avoidance motivation. *Motivation and emotion*, *30*(2), 111–116. https://doi.org/10.1007/s11031-006-9028-7

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Field, M., Kiernan, A., Eastwood, B., & Child, R. (2008). Rapid approach responses to alcohol cues in heavy drinkers. *Journal of Behavior Therapy and Experimental Psychiatry*, *39*(3), 209–218. https://doi.org/10.1016/j.jbtep.2007.06.001

Fricke, K., & Vogel, S. (2020). How interindividual differences shape approach-avoidance behavior: Relating self-report and diagnostic measures of interindividual differences to behavioral measurements of approach and avoidance. *Neuroscience & Biobehavioral Reviews*, *111*, 30–56. https://doi.org/10.1016/j.neubiorev.2020.01.008

Geraci, A., Regolin, L., Simion, F., & Surian, L. (2022). Infants' preferences for approachers over repulsers shift between 4 and 8 months of age. *Aggressive Behavior*, *48*(5), 487–499. https://doi.org/10.1002/ab.22033

Hay, D. F. (2017). The early development of human aggression. *Child Development Perspectives*, *11*(2), 102–106. https://doi.org/10.1111/cdep.12220

Huesmann, L. R., Eron, L. D., & Dubow, E. F. (2002). Childhood predictors of adult criminality: Are all risk factors reflected in childhood aggressiveness? *Criminal Behaviour and Mental Health*, *12*(3), 185–208. https://doi.org/10.1002/cbm.496

Kahveci, S. (2020). *AATtools: Reliability and scoring routines for the approach-avoidance task*. R package version 0.0.1. https://CRAN.R-project.org/package=AATtools

Kahveci, S., Rinck, M., van Alebeek, H., & Blechert, J. (2023). How pre-processing decisions affect the reliability and validity of the approach–avoidance task: Evidence from simulations and multiverse analyses with six datasets. *Behavior Research Methods*, *56*, 1551–1582. https://doi.org/10.3758/s13428-023-02109-1

Kanakogi, Y., Okumura, Y., Inoue, Y., Kitazaki, M., & Itakura, S. (2013). Rudimentary sympathy in preverbal infants: Preference for others in

distress. *PLoS One*, *8*(6), e65292. https://doi.org/10.1371/journal.pone.0065292

Kanakogi, Y., Inoue, Y., Matsuda, G., Butler, D., Hiraki, K., & Myowa-Yamakoshi, M. (2017). Preverbal infants affirm third-party interventions that protect victims from aggressors. *Nature Human Behaviour*, *1*(2), 0037. https://doi.org/10.1038/s41562-016-0037

Krieglmeyer, R., & Deutsch, R. (2013). Approach does not equal approach: Angry facial expressions evoke approach only when it serves aggression. *Social Psychological and Personality Science*, *4*(5), 607–614. https://doi.org/10.1177/1948550612471060

Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist*, *50*, 372–385. https://doi.org/10.1037/0003-066X.50.5.372

Leys, C., Ley, C., Klein, O., Bernard, P., & Licata, L. (2013). Detecting outliers: Do not use standard deviation around the mean, use absolute deviation around the median. *Journal of Experimental Social Psychology*, *49*(4), 764–766. https://doi.org/10.1016/j.jesp.2013.03.013

Lobbestael, J., Cousijn, J., Brugman, S., & Wiers, R. W. (2016). Approach and avoidance towards aggressive stimuli and its relation to reactive and proactive aggression. *Psychiatry Research*, *240*, 196–201. https://doi.org/10.1016/j.psychres.2016.04.038

Loijen, A., Vrijsen, J. N., Egger, J. I. M., Becker, E. S., & Rinck, M. (2020). Biased approach-avoidance tendencies in psychopathology: A systematic review of their assessment and modification. *Clinical Psychology Review*, *77*, 101825. https://doi.org/10.1016/j.cpr.2020.101825

Louise von Borries, A. K., Volman, I., De Bruijn, E. R. A., Bulten, B. H., Verkes, R. J., & Roelofs, K. (2012). Psychopaths lack the automatic avoidance of social threat: Relation to instrumental aggression. *Psychiatry Research*, *200*(2–3), 761–766. https://doi.org/10.1016/j.psychres.2012.06.026

Marsh, A. A., Ambady, N., & Kleck, R. E. (2005). The effects of fear and anger facial expressions on approach- and avoidance-related behaviors. *Emotion (Washington, D.C.)*, *5*(1), 119–124. https://doi.org/10.1037/1528-3542.5.1.119

Mason, W. A., Kosterman, R., Hawkins, J. D., Herrenkohl, T. I., Lengua, L. J., & McCauley, E. (2004). Predicting depression, social phobia, and violence in early adulthood from childhood behavior problems. *Journal of the American Academy of Child & Adolescent Psychiatry*, *43*(3), 307–315. https://doi.org/10.1097/00004583-200403000-00012

Polman, H., de Castro, B. O., Thomaes, S., & van Aken, M. (2009). New directions in measuring reactive and proactive aggression: Validation of a teacher questionnaire. *Journal of Abnormal Child Psychology*, *37*(2), 183–193. https://doi.org/10.1007/s10802-008-9266-0

Polman, H., Orobio de Castro, B., Koops, W., van Boxtel, H. W., & Merk, W. W. (2007). A meta-analysis of the distinction between reactive and proactive aggression in children and adolescents. *Journal of Abnormal Child Psychology*, *35*(4), 522–535. https://doi.org/10.1007/s10802-007-9109-4

Raaijmakers, M. A., Posthumus, J. A., van Hout, B. A., van Engeland, H., & Matthys, W. (2011). Cross-sectional study into the costs and impact on family functioning of 4-year-old children with aggressive behavior. *Prevention Science*, *12*(2), 192–200. https://doi.org/10.1007/s11121-011-0204-y

Rieffe, C., Broekhof, E., Kouwenberg, M., Faber, J., Tsutsui, M. M., & Güroğlu, B. (2016). Disentangling proactive and reactive aggression in children using self-report. *European Journal of Developmental Psychology*, *13*(4), 439–451. https://doi.org/10.1080/17405629.2015.1109506

Solarz, A. K. (1960). Latency of instrumental responses as a function of compatibility with the meaning of eliciting verbal signs. *Journal of Experimental Psychology*, *59*(4), 239–245. https://doi.org/10.1037/h0047274

Tremblay, R. E. (2010). Developmental origins of disruptive behaviour problems: The 'original sin' hypothesis, epigenetics and their consequences for prevention. *Journal of Child Psychology and Psychiatry*, *51*(4), 341–367. https://doi.org/10.1111/j.1469-7610.2010.02211.x

van Dijk, A., Hubbard, J. A., Deschamps, P. K. H., Hiemstra, W., & Polman, H. (2021). Do distinct groups of reactively and proactively aggressive children exist? A confirmatory latent profile approach. *Research on Child and Adolescent Psychopathology*, *49*(10), 1303–1317. https://doi.org/10.1007/s10802-021-00813-0

Veenstra, L., Schneider, I. K., & Koole, S. L. (2017). The effects of motivational training on state anger and aggressive impulses among people varying in trait anger. *Motivation Science*, *3*(4), 354–368. https://doi.org/10.1037/mot0000060

Veenstra, L., Schneider, I. K., Bushman, B. J., & Koole, S. L. (2017). Drawn to danger: Trait anger predicts automatic approach behavior to angry faces. *Cognition and Emotion*, *31*(4), 765–771. https://doi.org/10.1080/02699931.2016.1150256

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science*, *22*(4), 490–497. https://doi.org/10.1177/0956797611400615

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Van Bockstaele, B. (2024). Approach-avoidance tendencies in proactive and reactive aggression. *Aggressive Behavior*, *50*, e22162. https://doi.org/10.1002/ab.22162