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The development of social information processing and aggressive behaviour: Current issues

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The social information processing (SIP) model is an important element in theoretical accounts of the development of aggressive behaviour. Aggressive behaviour is associated with and predicted by specific social information-processing patterns and interventions targeting these patterns are relatively effective. The present article discusses three directions in which further progress can be made. First, the SIP *model* may be improved to take better account of emotional processes. Second, issues concerning the validity of SIP *assessment* need to be resolved. Third, differential *development* of SIP needs to be studied and to be related to development of specific aggressive behaviour patterns. Recent findings concerning these three issues are reviewed and directions for research are discussed.

Aggressive behaviour problems are the most frequent ground for admission to child mental health services. Presently, such behaviour problems in children are rated among the greatest concerns of the general public in

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western countries (e.g., for The Netherlands, Sociaal en Cultureel Planbureau, 1999). Children with excessively aggressive behaviour patterns are at increased risk of keeping these problems, of becoming delinquent, addicted to substances, rejected by peers, of dropping out of school, becoming unemployed, experiencing depressive episodes, and developing antisocial personality disorder (e.g., Coie & Dodge, 1998). Highly aggressive children may thus cause considerable psychological, physical, and material damage to themselves, their direct environment, and society at large.

The social information processing (SIP) model (Crick & Dodge, 1994; Dodge, 1986) is an important element in theoretical accounts of the development of aggressive behaviour. The present article aims to briefly review research on the SIP model and to discuss our approach to three fundamental issues concerning SIP: first, the SIP *model* may be improved to take better account of emotional processes; second, issues concerning the validity of SIP *assessment* need to be resolved; and, third, differential *development* of SIP needs to be studied and to be related to differential development of aggressive behaviour.

SOCIAL INFORMATION PROCESSING

The SIP model (Crick & Dodge, 1994; Dodge, 1986) proposes that, in order to respond appropriately to social situations, social information has to be processed in an orderly fashion. First, the information has to be *encoded* accurately. Second, the encoded information has to be *represented* correctly. Third, an appropriate interaction *goal* needs to be specified. Fourth, response alternatives have to be *generated* to attain this goal. Fifth, these response alternatives have to be *evaluated*, and from these responses an optimal response has to be selected. Finally, the selected response has to be *enacted*. According to the model, how a person proceeds through the steps in the model is determined by the stimulus situation, the person's information-processing capabilities, and a so-called "database". The database stores earlier experiences in the form of associations, memories, and schemata that are used in each step of information processing. Development in social information-processing would occur through increasing speed and efficiency in information processing and through experiences that change the database (Crick & Dodge, 1994; Dodge, 1993).

Numerous studies have been conducted concerning SIP in children who are hindered or provoked by a peer. These studies demonstrate that aggressive behaviour in children is related to atypical encoding, interaction goals, response generation, response evaluation, response enactment, and database schemata (e.g., Dodge, 1980, 1993; Dodge, Lochman, Harnish, Bates, & Pettit, 1997; Lochman & Dodge, 1998). Results concerning representation are less consistent. Representation has primarily been studied

in the sense of attribution of intent to other people's behaviour (also known as "hostile attribution bias"). A recent meta-analysis indicated that attribution of intent and aggressive behaviour are clearly related, but that results of empirical studies on this topic vary considerably (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002).

Longitudinal studies have shown that relations between early risk factors and later aggressive behaviour are mediated by SIP patterns (e.g., Pettit, Dodge, & Brown, 1988). Harsh physical punishment at an early age, for example, predicts deviations in social information processing, which in turn predict behaviour problems later in life (Weiss, Dodge, Bates, & Pettit, 1992).

The SIP model has also been used to validate distinctions between specific aggressive behaviour patterns. Accumulating evidence suggests that it may be important to distinguish between reactive and proactive aggression. Reactive aggression is aggressive behaviour performed in anger, in reaction to a presumed threat, whereas proactive aggression is planned, instrumental and "cold-blooded" behaviour (Dodge, 1991). Research indicates that these different forms of aggression are related to different precursors, correlates, and prognoses (Brendgen, Vitaro, Tremblay, & Lavoie, 2001; Dodge et al., 1997; Hendrickx, Crombez, Roeyers, & Orobio de Castro, 2003). Concerning SIP, it has been suggested that reactive and proactive aggression are uniquely related to different steps in the SIP model (Dodge, 1991). Encoding and attribution of intent are hypothesized to be related to reactive aggression, response selection to proactive aggression. Several studies support these hypotheses completely (e.g., Crick & Dodge, 1996) or in part (Dodge et al., 1997). So far, the evidence for specificity of SIP patterns for reactive and proactive aggression in referred children is not conclusive. Not all findings concerning this issue are in agreement and most research has so far been conducted with non-referred samples (Orobio de Castro et al., 2002).

Last but not least, SIP by aggressive children is a target for cognitive behavioural interventions to reduce behaviour problems. Interventions including SIP modification (Hudley & Graham, 1993; Lochman & Wells, 2002) are relatively effective (Kazdin, 2003) and mediation analyses indicate that the changes in aggressive behaviour resulting from these interventions are indeed caused by changes in SIP (Lochman & Wells, 2002).

Notwithstanding these impressive findings, important caveats in our understanding of SIP have been identified (Crick & Dodge, 1994; Lemerise & Arsenio, 2000). The main aim of the present article is to address three fundamental issues: (1) the proposed *structure* of the SIP model can be improved; (2) the validity of current SIP *assessment* is questionable; and (3) the model is not *developmental*. These issues have frequently been commented on (Crick & Dodge, 1994; Gottman, 1986; Orobio de Castro,

Koops, & Meerum Terwogt, 2004a), but have so far proved hard to resolve. Addressing these issues will improve our understanding of social information-processing mechanisms, the study of the development of aggressive behaviour patterns, and the design of effective intervention programs for aggressive behaviour problems.

In the following sections, I will discuss each issue in turn by stating the problem, proposing a solution, reviewing our recent work on the issue, and outlining a research agenda.

STRUCTURE OF THE SIP MODEL: REFLECTIVE AND EMOTIONAL PROCESSING

Despite the abundance of studies concerning SIP, the tenability of the model itself has rarely been studied. Nearly all studies concerning SIP have assumed the model to be correct and use this assumption as a base to study associations among various behaviour problems. The tenability of the model itself has been questioned in theoretical papers (Crick & Dodge, 1994; Orobio de Castro et al., 2004a), but it has not been tested empirically in children with aggressive behaviour problems.

Several authors have remarked that information processing as described by the SIP model is probably more rational, abstract, and reflective than children's real-life SIP, which is expected to proceed automatically (Crick & Dodge, 1994; Gottman, 1986). In everyday life, carefully assessing and evaluating available information, formulating multiple-response alternatives, and then rationally selecting the response with the best expected outcome is very rare even in trained decision makers, let alone in children with aggressive behaviour problems.

Researchers from different fields have acknowledged the importance of emotions in information processing (e.g., Frijda, 1993) and noted that emotions are not explicitly addressed in the SIP model. According to Crick and Dodge (1994): "Relatively little research has been conducted from an integrative perspective on social information processing and emotion. That is, few investigators have assessed the relation between social information processing and emotion and the impact of this relation on social adjustment. ... Clearly, it will be important for future research to consider carefully the role that emotion plays in social information processing and adjustment." (pp. 81–82). This is a surprising statement given the evident role of emotions like anger, envy, and glee in aggressive behaviour (see Orobio de Castro, 2000, for highly aggressive boys' self-reports in this regard) and effective interventions (Coping Power: Lochman & Wells, 2002; PATHS: Greenberg, Kusche, Cook, & Quamma, 1995).

Several roles of emotion in social information processing are likely (see also Lemerise & Arsenio, 2000). SIP may depend on a person's emotional

state in the following way. Encoding and representation may concern one's own and other people's emotions. Such representations may trigger emotions. These emotions, in turn, may predispose people to generate, select, and enact different responses. Or, in the case of intense emotions, they may impel an individual to generate a single response and enact it without any generation of, or selection from, alternative responses. Finally, emotions are at the core of an important class of responses: responses aimed at regulating one's own emotions. The SIP model does not incorporate these eminent roles of emotions explicitly.

Even though emotion is not specifically included in the SIP model, emotional aspects of information processing have often been indirectly involved in research designs. This section provides a short overview of existing research on emotions in SIP in aggressive children and the main findings of a number of studies that we recently conducted with highly aggressive boys to clarify the emotional aspects of SIP. Each of the latter studies was conducted with 30 to 55, 7- to 13-year-old participants in child psychiatric care or special education for aggressive behaviour problems and 30 to 60 non-referred participants in regular schools. Each of the studies required participants to individually listen to stories concerning provocation by a peer, and to answer questions about these stories.

Emotional state. It seems that deviations in SIP only occur when boys are emotionally involved in the situation presented, and that these deviations increase when participants feel threatened. The influence of participant involvement in presented situations was investigated in two studies with aggressive, rejected boys (Dodge & Frame, 1982; Dodge & Somberg, 1987). In the first study, participants were asked to imagine themselves as being either an onlooker or the injured party in vignettes presented to them. Hostile representation of intent was only found when they imagined themselves as the injured party. In the second study, during a pause in SIP tasks, they were confronted with the so-called real problem, staged by the experimenter, in which a child in the corridor was threatening to pick a quarrel with the them. The aggressive-rejected group did not differ from the popular-non-aggressive group in their representation of hostile intent before the threat, but represented more hostile intent after the threat.

We studied the influence of emotional sate on SIP in an experiment with a manipulated computer game (Orobio de Castro et al., 2003a). This game was used to induce negative emotions in boys with severe behaviour problems, aggressive boys in regular education, and non-aggressive boys. To this end, we manipulated the game to finish abruptly just before participants won a desirable prize. Both before and after this affect manipulation, they completed SIP tasks. After completion of these tasks, the game was played again in another manipulated version that ensured participants would win

their prize. Losing and winning the game led to the intended changes in emotional state in all participant groups. The affect manipulation led to an increase in hostile attributions of intent for the aggressive boys, but not for the other groups. This experiment clearly showed that aggressive boys are particularly susceptible to the effect of negative emotions on subsequent information processing.

Own emotions. Intense anger in aggressive boys is seen as an important source of their aggressive behaviour. Greater intensity of anger in boys with behaviour problems may lead them to react more aggressively than other children (Graham, Hudley, & Williams, 1992; Lochman & Lenhart, 1993). However, results of studies on self-reported anger in non-referred samples are inconsistent. While Graham et al. (1992) found that aggressive-rejected children became more angry than their non-aggressive peers, other studies (Quiggle, Garber, Panak, & Dodge, 1992; Waas, 1988) did not. In our studies (Orobio de Castro et al., 2003a; 2003b; 2004b), boys referred for aggressive-behaviour problems consistently indicate they become angrier than their non-referred peers after a provocation. Possibly, the effect only occurs in severely aggressive children, like the clinically aggressive boys in our study.

Others' emotions. Concerning encoding and representation of others' emotions, boys with behaviour problems appear to be inaccurate at identifying other children's emotions from pictures of emotion expressions (Cook, Greenberg, & Kusche, 1994; Izard, Schultz, & Ackerman, 1997). Whether this inaccuracy involves a tendency to systematically misattribute specific emotions (e.g., to consider a sad facial expression angry), and whether the inaccuracy also occurs when representing the social situations used in SIP research is, however, unclear.

We recently found that boys referred for aggressive-behaviour problems attributed different emotions to other children than their non-aggressive peers did. When distressed, aggressive boys more often indicate that other children enjoy their distress, or are at best indifferent to it (Orobio de Castro et al., 2004b). The latter finding remains true, even when aggressive boys attribute benign intentions to the children involved (Orobio de Castro, 2000).

Emotion regulation. Even intense anger does not necessarily lead to aggression. Most children learn to regulate anger and other negative emotions in circumstances where expression of these emotions would have adverse consequences (Cole, Martin & Dennis, 2004). In fact, young children are remarkably apt at emotion regulation, for instance by distracting themselves, or by intentionally devaluing the goal they were

pursuing (Stegge, 1995). Anger coping programs (e.g., Lochman & Lenhart, 1993) are based on the assumption that boys with behaviour problems are less skilled at regulating anger, and therefore more often act aggressively when angered than their peers do. Several studies indicate that aggressive behaviour is related to a combination of high negative emotionality and limited emotion-regulation skills (Cole, Martin, & Dennis, 2004).

There has, however, been little research on the relation between emotion regulation and SIP. In a non-referred sample, Hubbard, Parker, Ramsden, and Smithmyer (1998) found that aggression was related to lack of skill and motivation in regulating emotion. In our studies (Orobio de Castro et al., 2003b; 2004b), generation of emotion regulation strategies was assessed in response to hypothetical vignettes of peer provocation. Referred aggressive boys mentioned less adaptive emotion regulation strategies than comparison boys. Those in the comparison group more often mentioned solutions and distraction, whereas boys in the aggressive group more often did not know a strategy to regulate their emotion and more often said emotion could only be regulated by others. More aggressive than comparison boys mentioned aggression as a way to regulate negative emotions (e.g., by stating, "If I smudge his painting too, then he'll cry and it's my turn to laugh"). The generation of adaptive emotion regulation strategies was negatively related to aggressive response generation and aggressive behaviour in class.

Interaction goals and response selection. From a rational stance, the inclusion of "interaction goals" in the social information-processing model makes sense: one can only select an optimal response if one uses a goal as a standard against which to evaluate possible responses. However, from an emotional point of view, it is very possible that aggressive boys' behaviour does not result from a deliberate response in order to obtain a goal. Rather, responses may simply result from a strong emotional action tendency that is executed without any goal or outcome in mind. This is exactly what our studies indicate for aggressive boys (Orobio de Castro et al., 2000, 2003a, 2003b, 2004b). They generally respond aggressively, do not select the responses that they expect to have the best outcome, and frequently indicate their responses resulted from intense anger that "made them" act aggressively (e.g., "I'll go mad with anger"). In contrast, non-aggressive boys generally respond non-aggressively and select responses that would best help them attain their predominantly pro-social goals.

In sum, all emotional aspects of SIP that have been studied are related to aggressive behaviour. Moreover, controlling for possible confounding effects of group differences in verbal intelligence and socially desirable answering tendencies in our studies did not alter these findings.

INCORPORATING EMOTIONS IN SIP MODELS

The above critique and research findings have led to changes in the SIP model (Crick & Dodge, 1994; Lemerise & Arsenio, 2000). Though these revisions were meant to accommodate automatic and emotional information processing, they mainly concerned additions of more reflective elements to the model. Whether these changes are parsimonious, and whether they account for emotional and automatic processes has not been tested empirically to date. The value of each modification will have to be tested empirically.

I would like to suggest an alternative SIP model based on current knowledge of emotion processes and information processing (e.g., Anderson & Bushman, 2002; Frijda, 1993). An improved SIP model should account for both the demonstrated relations between reflective processing and behaviour and the proposed relations between emotional processing and behaviour. It should also specify when both emotional and reflective processes are activated. In light of the outlined importance of *both* reflective and emotional information processing, I would like to propose a *dual-processing model*. The model specifies an emotional and a reflective route from social stimulus to response.

On the emotional route, basic cues are encoded and a basic appraisal of their valence and relevance to personal concerns is made. If the cues are appraised as highly relevant an emotional action tendency is triggered. The quality of this tendency depends on the appraised valence and relevance of the cues. For example, if the cues are deemed highly relevant and detrimental to one's goals, an angry action tendency is triggered, including high arousal, muscle tension, and facial expression. This action tendency directly triggers the dominant response for the given tendency (e.g., hitting or shouting in case of anger). Note that no complex representation of others' intent or generation and selection of multiple responses occur on this route.

The reflective route is superimposed on the emotional route. Following encoding and appraisal of cues as highly relevant, resulting action tendencies may be encoded themselves and be appraised as detrimental to one's own goals, this appraisal triggers reflective processing, including allocation of attention to the stimulus, reappraisal of the encoded information, including representation of intent and emotional state of others involved in the social event. This reappraisal triggers a response that is evaluated and enacted when evaluated positively. If the response is evaluated negatively, an alternative is generated, and so on.

Whether either the emotional or the reflective route is taken may depend on stimulus characteristics, emotional state, and an individual's stable predisposition to (over- or under-) control action tendencies (Van Aken, Van Lieshout, Scholte, Haselager, & Gerbert, 2002). Individual differences

in ego-control determine the extent to which emotional processing is monitored and regulated by reflective processing. The reflective route is only taken if emotional involvement is not too strong to control given one's level of ego-control. All other processing follows the emotional route. The emotional action tendency in the model starts from the individual's emotional state before the stimulus occurred. Thus, in a strongly negative emotional state, a smaller negative appraisal evokes a stronger action tendency, making it less likely that the reflective route is followed.

Along the emotional route, aggressive behaviour occurs when an individual is in a negative emotional state, encounters threatening social stimuli, encodes negative information, appraises relevance and negative valence, has strong action tendencies, and tends to under-control his own action tendencies. Aggressive behaviour may also result from the reflective route, if representations enhance rather than decrease the appraisal of relevance and valence and if aggressive responses are evaluated positively. Thus, both the emotional and the reflective route may explain aggressive behaviour, albeit of different kinds. The distinction between the two routes may be particularly useful to explain differential development of reactively and proactively aggressive behaviour, as I will explain below.

This model is clearly highly speculative. However, there are indications of its tenability in the literature reviewed above. Of course, the proof of the pudding is in the eating. To test the explanatory value of the proposed dual-processing model, adequate measures for both reflective and emotional SIP are needed. The next section therefore concerns the assessment of SIP.

THE ASSESSMENT OF SIP: FROM HYPOTHETICAL REFLECTION TO EMOTIONAL PROCESSING?

Although the research methods used in the studies discussed above differ in some respects, the general approach in most of them is to present hypothetical vignettes concerning potentially problematic interactions with peers. Before the situations are presented, participants are asked to imagine that they actually experience the hypothetical situation themselves. The situation is then presented and halted at the moment a problem arises. The participant is then asked questions concerning the SIP model. Such assessment procedures clearly require reflective processing of social information. The validity of reflective measures of SIP by aggressive boys has often been questioned (Crick & Dodge, 1994; Vasey, Dalgleish, & Silverman, 2003) and may be problematic for the assessment of emotional information processing. Two studies demonstrated relations between reflective SIP and actual aggressive behaviour in staged social conflicts (Dodge et al., 1986; Van Nieuwenhuijzen et al., 2004). Crick and Dodge (1994) propose that aggressive boys' deviancies in emotional processing are

essentially the same as their deviancies in reflective processing following the SIP model, a suggestion that clearly needs to be tested.

Some evidence suggests that findings obtained with reflective SIP measures depend on participants' emotional involvement. We recently conducted a meta-analysis concerning the relation between hostile attribution of intent and aggressive behaviour in children (Orobio de Castro et al., 2002). A striking finding in this analysis was the extent to which findings depend on variations in assessment procedures for SIP. To illustrate this phenomenon, Figure 1 shows mean correlations between hostile attribution of intent and aggressive behaviour by severity of aggression and stimulus presentation mode. In line with SIP theory, associations were stronger for children with more severe aggressive-behaviour problems. However, relations depended strongly on presentation mode as well. Presentation of social stimuli by video resulted in null-findings or very small effects, whereas audio presentation resulted in moderate effects and staged real-life situations resulted in large effects. Possibly, the effect of presentation mode on effect sizes can be explained by participant's emotional involvement: Actually engaging in a social interaction seems more involving than being addressed vocally in a hypothetical event. Seeing a social interaction between other children on video may be even less involving.

If SIP assessment by means of hypothetical vignettes is not emotionally involving and taps into participant's conscious reflection on their behaviour, it may only be suitable to assess reflective information processing. Assessment of emotional information processing would clearly require a

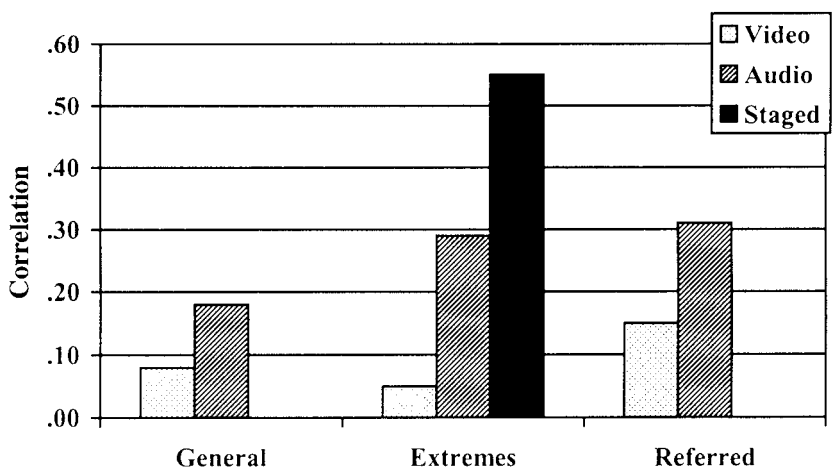

Figure 1. Mean correlations between hostile attribution of intent and aggressive behaviour by severity of behaviour problems and stimulus presentation mode (based on Orobio de Castro et al., 2002).

different approach. It may be necessary to stage actual emotionally engaging social interactions between participants (e.g., Lochman & Dodge, 1998) and to use a combination of real-time indices of emotional processing, such as observation, reaction times, vagal tone, and skin conductance (e.g., Hubbard et al., 2002).

THE DEVELOPMENT OF SIP, REACTIVE, AND PROACTIVE AGGRESSION

The SIP model has been used to explain differential development of reactive and proactive aggression. Longitudinal studies including SIP have mainly addressed how SIP at one point in time is associated with the development of aggressive behaviour patterns. The present SIP model does not, however, specify how SIP *itself* develops over time (cf. Gottman, 1986). Consequently, no developmental study of SIP has been conducted to date. There have been longitudinal studies of SIP as a mediator between early experience and later behaviour, but these did not address the development of SIP itself. Other studies have cross-sectionally compared SIP in different age groups, but given the lack of hypotheses regarding development, tests for age-effects in these studies were all exploratory and yielded inconsistent findings (see Orobio de Castro et al., 2002). It does seem, however, that clear hypotheses concerning SIP development may be formulated and tested. A first attempt may illustrate this.

From soon after birth, nearly all children behave aggressively. In most children, this aggressive behaviour diminishes, while in a small proportion it remains present and diversifies (Tremblay, 2000). So, what needs to be understood is not how changes in SIP cause the ''onset'' of aggressive behaviour, but the opposite: We need to study how most children's SIP changes to make them *less* aggressive. This reversal from studying onset of aggression to studying ''offset'' of aggression is not just an academic matter, but has fundamental implications for our understanding of SIP and aggressive behaviour. It suggests that SIP involved in aggressive behaviour must be a very basic, simple process, while SIP in non-aggressive behaviour may be more complex and acquired over time. From the dual-processing model suggested above we may tentatively derive specific hypotheses, which we would like to test in the near future, concerning the development of SIP and its relations with reactive and proactive aggression in line with current theories on emotional and social cognitive development.

One may propose that three trajectories in the development of SIP, reactive, and proactive aggressive behaviour can be identified: (1) a general trajectory, followed by most children, from reactive aggression and emotional processing to little aggression and reflective processing; (2) a persistent reactive trajectory with stable high levels of reactive aggression,

under-control, and emotional processing; and (3) a proactive trajectory, with increasing levels of proactive aggression and an atypical reflective information processing style.

On the general trajectory, SIP in infants and young children may be described by the emotional route: any cue associated with goal blocking will evoke an anger action tendency that directly leads to aggressive behaviour. As their cognitive capabilities mature and they are engaged in more complex social interactions, children acquire reflective SIP skills that enable them to inhibit emotional SIP and follow the reflective route both by taking into account others' intentions and feelings and by considering the likely consequences of multiple response alternatives. They come to appreciate the social norm that the extent to which aggressive responses are appropriate depends on others' intentions and feelings. Thus, what develops is not a tendency to attribute hostile intent, but the skill to detect benign intent and to modify one's response accordingly. Similarly, alternative responses to aggression are tried out and reinforced. These reflective SIP skills do not replace the emotional route, but adjust it under those circumstances where society deems it inappropriate.

On the persistent reactive trajectory, emotional information processing may remain dominant in under-controlling children as either the reflective skills are never learned or emotional action tendencies are so strong that they are hard to regulate. Persistent reactive aggression is present from an early age and is associated with difficult temperament, attention problems, negative mood, social problems, and low intelligence. Reactive aggression may persist in children who do not develop skills to use the reflective route. This proposition is in line with findings that reactively aggressive children encode more negative cues and that their aggressive responses are hardly related to reflective SIP steps of response selection and response evaluation. Failure to develop reflective information processing may result from transactions between temperament, under-control, and an unsuitable environment in which to learn reflective skills.

On the proactive trajectory, reflective processing may develop atypically when aggressive responses are reinforced. Proactive aggression emerges almost exclusively in children who already display reactively aggressive behaviour. It is not associated with social problems, but rather with effective use of aggression in the child's own interests (Merk, Orobio de Castro, & Koops, in press). Possibly, proactive aggression emerges when reflective SIP skills do develop. Such could be the case if the reinforcement of aggressive behaviour together with the examples provided by aggressive models lead to different contents of reflection than those found in most children, particularly to less attribution of benign intent, instrumental interaction goals, and positive outcome expectancies for aggressive behaviour.

Clearly, the developmental trajectories proposed above are completely speculative and have not been subjected to empirical study yet. They do, however, provide a first idea of how a *developmental* approach to SIP and aggressive behaviour may be useful to generate hypotheses. To test these hypotheses, we plan to conduct a longitudinal study concerning the development of reactively and proactively aggressive behaviour and the dual-processing model of SIP.

Analysing means or bivariate relations over time will not be sufficient to test the above hypotheses. Two consecutive data-analytic steps need to be taken. First, the proposed developmental trajectories for dual processing and aggressive behaviour need to be identified. Second, it has to be demonstrated that children in a certain developmental trajectory for processing also follow the proposed developmental trajectory for aggression. Fortunately, recent advances in methodology allow such complex tests of parallel developmental trajectories (e.g., Muthén & Muthén, 2000; Nagin, 1999; Van Lier, 2003).

DISCUSSION

The social information-processing (SIP) approach to aggressive behaviour contributes significantly to our understanding of the development of aggressive behaviour. SIP and aggressive behaviour are meaningfully related, SIP mediates relations between organismic factors, experience and aggressive behaviour, and interventions targeting SIP have been shown to decrease aggressive-behaviour problems.

Notwithstanding these achievements, the present SIP approach faces three challenges. First, the model itself can be improved by including emotional processes in addition to reflective SIP. Second, assessment of SIP needs to be improved. And third, the development of SIP is not well understood. We discussed these issues by briefly reviewing theories and research, reviewing work we recently conducted, and outlining possible avenues for future research.

Overviewing the ideas and findings on these issues, it appears they are inextricably connected: studying the development of SIP requires valid assessment and valid assessment in turn requires a sound and parsimonious model of SIP. Notwithstanding the impressive advances made so far, there still is a long way to go. Important research directions seem to include (but are certainly not limited to): reformulations of SIP models to test for their explanatory value; design and testing of valid assessment procedures for different aspects of SIP; and longitudinal-experimental studies of relations between the development of SIP and the development of aggressive-behaviour patterns.

Though complex, these tasks do seem feasible as rapid developments in statistics and assessment provide new opportunities to assess different aspects of information processing, to test structural models and to test hypotheses concerning developmental trajectories. Resolving these issues will contribute greatly to our understanding of the development of social behaviour (Anderson & Bushman, 2002; Rutter, 1998) and is considered critical to the development of more effective (cognitive behavioural) interventions (Kazdin, 2003; Vasey et al., 2003).

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