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SPECIAL SECTION: INFORMATION-PROCESSING FACTORS IN CHILD AND ADOLESCENT PSYCHOPATHOLOGY

The Information-Processing Paradigm: A Valuable Framework for Clinical Child and Adolescent Psychology

Patricia Bijttebier

Department of Psychology, University of Leuven, Belgium

Michael W. Vasey

Department of Psychology, Ohio State University

Caroline Braet

Faculty of Psychology and Educational Sciences, Ghent University, Belgium

Provides an introduction to the special section on information-processing (I-P) factors in child and adolescent psychopathology. First, we describe the I-P paradigm and summarize its central tenets, presenting examples of past research that illustrate the heuristic value of the paradigm. Next, we discuss the potential benefits of the I-P paradigm for the field of clinical child and adolescent psychology. Finally, we present an overview of the articles in the special section.

Given the prominence of the social information-processing theory of childhood aggression advanced by Crick and Dodge (1994), most readers of the *Journal of Clinical Child and Adolescent Psychology* are likely to be at least somewhat familiar with the information-processing (I-P) paradigm. Further, the large body of research stemming from Crick and Dodge's theory would seem to provide ample demonstration of the potential heuristic value of the I-P paradigm for the field of clinical child and adolescent psychology. However, despite the fruitfulness of this theory, as well as the success of I-P approaches to adult psychopathology (e.g., Beck & Clark, 1988, 1997; Williams, Watts, MacLeod, & Mathews, 1997), until recently the I-P paradigm has had surprisingly little impact on research concerning child and adolescent problems other than aggression. Thus, it is likely that many aspects of this conceptual framework remain unfamiliar to many in the field. Moreover, there are aspects of the I-P paradigm that have not been emphasized even in the well-developed domain of the social I-P theory of aggression, such as memory, selective attention, and automatic aspects of processing. Therefore, this special section is intended to familiarize readers with the ma-

ior elements of the I-P paradigm and illustrate its heuristic value for the field.

This article provides an introduction to the special section and as such describes the I-P paradigm, presents examples of past research reflecting its influence, and introduces the articles in the section. These articles were selected to illustrate aspects of or approaches to I-P factors that heretofore have received little or no attention in the child and adolescent psychopathology literature. In some of the articles, new approaches are taken to child and adolescent problems that already have been the focus of past I-P research (e.g., aggression). In other cases, however, they focus on topics, such as obesity and psychopathy in childhood and adolescence, to which the I-P perspective has not previously been applied.

Overview of the I-P Paradigm

The I-P paradigm is a conceptual framework that assumes that many aspects of human behavior and experience, both typical and atypical, can be understood in terms of how information from both external and internal sources is processed. The I-P paradigm is an example of a model, which Rapport (2001) described as "a framework, structure, or system that is borrowed from a different field and applied to the current field.

Requests for reprints should be sent to Patricia Bijttebier, Department of Psychology, University of Leuven, Tiensestraat 102, 3000 Leuven, Belgium. E-mail: Patricia.Bijttebier@psy.kuleuven.ac.be

... Models typically serve as an analogy or metaphor to guide thinking and research” (p. 6). In the case of the I-P perspective, the root metaphor is that of the person as computer (Johnson-Laird, 1993; Lachman & Lachman, 1986). Specifically, the person is conceptualized as an I-P system, with the focus on how that system functions to select, interpret, encode, store, and retrieve information and ultimately how those processes contribute to the generation and execution of behavior. Thus, the I-P paradigm is a broad conceptual meta-theory that guides the development of theories of specific problems.

As is true of any conceptual paradigm, the assumptions of the I-P paradigm are not typically the focus of research (Rapport, 2001), and the paradigm per se is neither true nor false. Rather, as noted by Dalgleish (in press), its value depends on how fertile it proves to be for generating and testing specific theories, in this case, of child and adolescent psychopathology. According to this standard, the I-P paradigm has clear value. Indeed, it is the dominant paradigm in cognitive psychology, in large measure because of its demonstrated heuristic value for studying a broad array of cognitive phenomena (Dalgleish, in press).

The I-P paradigm may be particularly useful because it provides a broadly applicable “methodology for theorizing” (Anderson & Bower, 1973). This construction kit facilitates both model design and, because it is associated with a common core of methodology, model testing. This common methodological core typically involves the use of performance-based dependent variables, such as reaction time, free recall, and recognition memory. These are embedded within experimental contexts that are carefully designed to eliminate or constrain the potential influence of all but the target aspect(s) of processing. For example, a study by Vasey, Daleiden, Williams, and Brown (1995) illustrated how reaction time can be used to measure the process of attention allocation when several stimuli compete for processing priority. Specifically, Vasey and colleagues used a measure of probe detection latency to test the hypothesis that, in contrast to controls, children diagnosed with anxiety disorders would selectively attend to threat-relevant words more than to competing neutral words. They utilized a version of the probe detection task developed for use with adults by MacLeod, Mathews, and Tata (1986). This task presents pairs of words for a brief interval (i.e., 1250 msec) one above the other on a computer screen. These words compete for attention, and their content is systematically varied such that the words are either both neutral in content (e.g., “cart” and “tape”) or one is threat-relevant and the other neutral (e.g., “murder” and “apple”). On a subset of trials, a probe (i.e., a dot) appears in the position of one of the two words subsequent to their disappearance. Children indicate their detection of these probes by pressing a button, and these probe detection

latencies provide the basis for a measure of relative attention to threatening versus neutral words. Specifically, a child who selectively attends to threatening words will, on average, detect probes more rapidly when they follow threatening words than when they follow neutral words. Indeed, the results reported by Vasey et al. (1995) were consistent with this expectation.

The merits of such performance-based measures have been discussed at length elsewhere (Ingram & Kendall, 1986; MacLeod, 1993; Vasey & Lonigan, 2000) and thus are only briefly reviewed here. In general, such methods provide an important adjunct to self-report measures. Self-reports are generally limited to aspects of cognitive processing that are available to conscious awareness. Moreover, even when a person has conscious access to a cognitive product, the processes leading to that product often occur outside of conscious awareness and may thus be unavailable for self-report (e.g., see Bargh & Chartrand, 1999). In many cases, self-reports regarding such products have little to do with their actual determinants, in part because they are subject to the effects of factors such as social desirability, defensiveness, and self-deception (Bargh & Chartrand, 1999; Ingram & Kendall, 1986; Nisbett & Wilson, 1977). Performance measures may be less susceptible to such influences and thus may provide information that is difficult to collect in other ways. However, such measures have their own limitations (see Vasey, Dalgleish, & Silverman, this issue) and thus should be regarded as augmenting rather than replacing other types of measures.

The I-P perspective has a number of central tenets (see Dalgleish, in press, and Williams et al., 1997, pp. 16–43, for more detailed discussion), the first of which is the assumption that processing occurs through a *series of stages*, with the products of later stages of processing depending, at least in part, on the output of earlier stages in the sequence. This tenet is clearly illustrated by the social I-P theory of aggression (see Crick & Dodge, 1994). In its original form (Dodge, 1986), the social I-P theory described a linear series of discrete stages through which information passed, with the output of each stage serving as the input for the next: (a) encoding, (b) interpretation, (c) response generation or access, (d) response selection, and (e) response enactment. Although evidence suggests that some aspects of processing do indeed occur in this manner (e.g., serial search among some types of distractors; see Treisman, 1988), many aspects of processing may also operate in parallel fashion. In keeping with such developments, Crick and Dodge revised their social I-P theory such that the various processing steps are presumed to operate in parallel, with processing in each step potentially influencing other aspects of ongoing processing. However, even in this revised model, processing of a specific element of information

is presumed to occur serially. Thus, the theory predicts that deficient or biased output in later stages of processing may be due to faulty processing earlier in the sequence. Although the mediational effects suggested by this assumption have rarely been tested to date (Crick & Dodge, 1994), they are a potentially important aspect of the I-P perspective that warrants greater attention in the future (e.g., see Schippell, Vasey, Cravens-Brown, & Breveld, this issue; Vasey et al., this issue).

Second, and perhaps most important, all I-P theories assume that the I-P system has *limited capacity*. The presumed source of such limits varies across theories, with some postulating a common, undifferentiated pool of resources (e.g., attention or effort), whereas others suggest that capacity limits reflect competition between tasks for specific processing modules (Pashler & Johnston, 1998; Styles, 1997). However, regardless of their precise basis, capacity limits necessarily lead to competition for processing resources and thus to *selective processing*. Because the amount of information available for processing at a given moment in most situations far exceeds the I-P system's limited capacity, resources must be selectively allocated to some steps in the I-P sequence as opposed to others or to some subset of the total available information.

With respect to the encoding stage of information processing, Crick and Dodge (1994) used the concept of "attentional intensity" to the amount of processing resources that a child allocates to the encoding of information as opposed to other aspects of processing (see also Daleiden & Vasey, 1997). Studies of attentional intensity have been limited mainly to the domain of childhood aggression. For example, Dodge and Newman (1981) measured the attentional intensity of aggressive boys by examining the number of social cues these children employed in making interpretations. The children were asked to play a detective game during which they could listen to as many (up to a maximum of five) audiotaped testimonies as they felt necessary for them to be confident in their decision about a suspect's guilt or innocence regarding various acts. Dodge and Newman found that, compared to nonaggressive controls, aggressive boys devoted fewer processing resources to the acquisition of information about a child's guilt or innocence before proceeding to the interpretation stage of processing. Using a similar approach, Muris, Merckelbach, and Damsma (2000) demonstrated that socially anxious children sought significantly less information than controls before deciding whether an ambiguous story was threatening.

Attentional selectivity refers to the processes by which some information is selected for processing whereas other information is ignored. Such selective resource allocation may be partly a function of stimulus characteristics such as intensity or salience but is also clearly subject to internal control (Williams et al.,

1997). Theories differ as to the specific source(s) of such internal control, whether by a central executive system (e.g., Broadbent, 1982), passive mechanistic priming of cognitive structures (e.g., Johnston & Dark, 1986), or some combination of these factors (e.g., Duncan & Humphreys, 1989). However, in any case, differential processing appears to reflect the operation of processes leading to *activation* or *inhibition* of some cognitive content relative to other content (Williams et al., 1997). For example, attending to a priming stimulus facilitates processing of related stimuli, suggesting their activation in memory (e.g., Warren & Morton, 1982). In contrast, intentionally ignoring a priming stimulus leads to impaired processing of related stimuli, suggesting the inhibition (i.e., a reduction in activation) of such cognitive content (e.g., Tipper, 1985).

Biases of selective attention are among the most extensively studied I-P biases, in children and adults alike and often in relation to anxiety. Research has consistently shown that anxiety disorders, as well as high levels of trait anxiety, are characterized by heightened attention for threat-relevant information (Schippell et al., this issue; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000; Vasey et al., 1995; Vasey, El-Hag, & Daleiden, 1996). It may, however, be expected that selective attentional biases play an important role in other types of childhood problems too, such as eating disorders (see Braet & Crombez, this issue) and aggressive behavior problems (see Schippell et al., this issue).

As noted by Dalgleish (in press), the twin notions of limited capacity and processing selectivity provide a useful framework for understanding many aspects of psychopathology. For example, the cognitive impairments associated with anxiety may reflect the selective devotion of processing resources to anxiety-relevant information, which thus reduces resources available for other activities (see Vasey & Daleiden, 1996). Such "cognitive interference" may in turn lead to performance deficits that contribute to anxiety-intensifying failure experiences (Vasey & Dadds, 2001). Moreover, to the extent that anxiety disorders are associated with an I-P system that is "tuned" to selectively process anxiety-relevant information, anxiety may be maintained or intensified, leading in turn to maintenance or exacerbation of anxiogenic patterns of information processing (e.g., see Beck & Clark, 1997).

Although the computer metaphor underlying the I-P perspective may seem to imply that the system passively reacts to informational input, considerable research makes it clear that much if not most cognitive processing is actively goal-directed (Williams et al., 1997). Such goal direction requires feedback mechanisms to be built into the I-P system such that information moves in both directions rather than proceeding passively from input to output. A purely passive model of processing that is driven in exclusively "bottom-up"

fashion by stimulus characteristics is untenable due to the enormous demands such a passive system would make on processing resources. Therefore, processing must be governed at least in part by “top–down” operations that enable the selective processing required by capacity limits (Williams et al., 1997). Although the precise source of such top–down controls on processing varies across theories, in general, the I-P perspective postulates the existence of memory structures (e.g., schemas) that organize stored information.

When memory structures are activated (either passively via priming or actively via executive control), they serve to guide the input and processing of further information. Stimuli consistent with the existing structures are elaborated and encoded, whereas inconsistent or irrelevant information is ignored or forgotten. For example, according to Beck’s (1976) schema theory, emotional disorders are characterized by maladaptive schemata and the themes present in these faulty schemata differ across disorders. In depression, the prominent schemata concern negative views of the self, the world, and the future, whereas in anxiety, the key schemata are organized around themes of vulnerability and danger. Given that schemata direct processing resources to those aspects of the external or internal environment that are congruent with them, persons with maladaptive schemata are subject to a number of cognitive biases. Moreover, it is expected that cognitive biases for particular types of affective material are specific to some disorders but not others (e.g., depression-related stimuli specific to depression, threat-related stimuli specific to anxiety); the latter hypothesis is referred to as the content-specificity hypothesis (Beck, Rush, Shaw, & Emery, 1979), and it is one focus of the study by Dalgleish et al. (this issue).

A final important distinction associated with the I-P perspective is that between *automatic* and *strategic processing* (e.g., Hasher & Zacks, 1979; Shiffrin & Schneider, 1977). Automatic processes are typically described as being rapid, inflexible (i.e., occurring in invariant manner), involuntary, and requiring no processing resources (i.e., they require no attention or conscious effort). In contrast, controlled processing, which is also referred to as strategic or effortful processing, is described as being slow (relative to automatic processing), flexible, voluntary, and requiring processing resources. For example, in their theory of anxiety and depression, Williams et al. (1997) drew a critical distinction between automatic and controlled processing. Specifically, they argued that anxiety is associated with automatic processing biases, whereas depression is related to effortful processing biases. Unfortunately, the distinction between automatic and controlled processing has, as yet, had little impact on child and adolescent psychopathology research. For example, most research on the social I-P theory of aggression has relied on measures that permit considerable

potential for controlled processing (Crick & Dodge, 1994). However, the few studies that have looked at processing under conditions that limit opportunities for controlled processing suggest that it may differ substantially from what is seen when more typical assessment approaches are used (e.g., Rabiner, Lenhart, & Lochman, 1990).

Potential Benefits for Clinical Child and Adolescent Psychology

The conceptual framework provided by the I-P perspective has a wide range of potential benefits for the field of clinical child and adolescent psychology (Ingram, 1989; Ingram & Kendall, 1986). In general, these benefits reflect the previously discussed heuristic features of the paradigm that have led to its success in the broader domain of cognitive psychology.

First, the I-P paradigm provides numerous theoretical constructs that foster both conceptualization of and empirical research on cognitive factors in psychopathology. Thus, the paradigm provides a framework for conceptualizing and studying a wide range of cognitive processes that support normal and abnormal development, contributing to risk or resilience and thus protecting against or predisposing to and fostering the development, maintenance, or amelioration of psychopathology. The potential value of the paradigm for conceptualizing psychopathology is illustrated by the fertility of Dodge’s social I-P theory of aggression (see Crick & Dodge, 1994; Harvey, Fletcher & French, 2001). Moreover, the general heuristic value of that I-P model is illustrated by its value when used to conceptualize normal and abnormal aspects of emotion regulation (Garber & Dodge, 1991). For example, Garber, Braafladt, and Zeman (1991) used this framework to conceptualize the regulation of negative affect in normal children and how it may go awry in depression.

Considering child and adolescent psychopathology from the I-P perspective is particularly valuable because it directs attention toward a wide range of cognitive processes that may mediate or even moderate the relations between elements at other levels of analysis. Dalgleish (in press) argued that the I-P perspective is complementary to “higher-level” psychosocial accounts and “lower-level” neurobiological accounts of human behavior and experience. Indeed, Dalgleish noted that there is a high degree of congruence between brain regions or neural circuits and the systems postulated by I-P theories. Thus, the I-P perspective may be useful for refining and testing theoretical models because it fosters integration of higher-level psychosocial accounts with lower-level neurobiological accounts. For example, neurobiological accounts of aggression suggest that different neural systems are involved in reactive aggression (RA) and proactive ag-

gression (PA; Blair, 2002). Similarly, each type of aggression appears to be related to distinct psychosocial risks and outcomes (e.g., Poulin & Boivin, 2000; Schwartz et al., 1998). Consideration of I-P factors suggests processes by which individual differences in these neural systems produce sensitivity or vulnerability to specific classes of psychosocial risk and contribute to the distinct outcomes associated with RA and PA. Indeed, Dodge and colleagues have used their social I-P theory to hypothesize and demonstrate several critical differences in processing between these two types of aggression (e.g., Crick & Dodge, 1996; Hubbard, Dodge, Cillessen, Coie, & Schwartz, 2001).

A second benefit of studying child and adolescent psychopathology from the I-P perspective is that doing so may lead to refinements in our definitions of various disorders or syndromes and distinctions among them. For example, as discussed previously, many of the findings supporting the divergent validity of the constructs of RA and PA have their basis in the I-P perspective (e.g., see Schippell et al., this issue). Another example of such a refinement can be found in the study reported by Loney, Frick, Clements, Ellis, and Kerlin (this issue). Specifically, Loney and colleagues used I-P concepts and methods to demonstrate that individual differences in callous–unemotional traits are associated with differences in the responses of antisocial youth to emotionally negative information. This finding provides further support for the view that antisocial youth who are characterized by high levels of callous–unemotional traits are distinct in important ways from those who have relatively low levels of such characteristics (Blair, Jones, Clark, & Smith, 1997; Frick et al., in press).

Third, the I-P paradigm permits researchers to draw on its associated methodological toolbox, which provides powerful and flexible approaches to testing cognitive theories of child and adolescent psychopathology. Moreover, these techniques may lead to the development of more sensitive approaches to assessing various symptoms, syndromes, and disorders. For example, many of the cognitive biases, deficits, and distortions associated with psychopathological conditions may be unavailable to conscious awareness and thus not amenable to self-report assessment methods. Alternatively, children may dissimulate about their symptoms and parents and other reporters may lack sufficient access to some aspects of child and adolescent psychopathology to permit them to provide valid reports. Thus, I-P measures may provide an important adjunct to such measures for some aspects of psychopathology (Vasey & Lonigan, 2000). However, it is important also to note that I-P measures are often time consuming and labor intensive to administer. Further, information regarding reliability and validity of such measures is often lacking, and it remains to be seen if the potential clinical utility of such measures can be re-

alized (see Vasey & Lonigan, 2000). Although such tasks are sufficiently reliable to yield group differences, they often contain sufficient measurement error to preclude their utility for assessment of individual cases (see Vasey et al., this issue). Thus, more research on the reliability and validity of such tasks is needed if their promise is to be realized.

Fourth, consideration of I-P factors can provide a model for understanding the processes that account for the efficacy of various clinical interventions and may also help to highlight additional targets for interventions. Although such work has yet to be extended to children and adolescents, research suggests that the attentional bias toward threat-relevant information that is associated with anxiety may be an important target for intervention. For example, Mogg, Bradley, Millar, and White (1995) showed that successful treatment of adults diagnosed with generalized anxiety disorder was associated with elimination of their attentional bias toward threat cues and treatment gains appeared to be mediated by changes in attentional bias. Such findings suggest the potential value of interventions targeted directly at correcting the attentional bias. Consistent with this view, Hazen, Vasey, and Schmidt (2002) found that a computer-based attentional retraining program was significantly more effective than a sham training (i.e., placebo) program in reducing anxiety symptoms in college students identified as chronic worriers.

Finally, consideration of I-P factors may be useful in identifying children and adolescents who are vulnerable to the development or persistence of psychopathology or to relapse subsequent to therapy, although this potential has yet to be realized in child or adolescent samples. For example, as discussed by de Decker, Hermans, Raes, and Eelen (this issue), several studies suggest that a pattern of overgeneral autobiographical memory is a strong predictor of the prognosis of depressive symptoms in adults. For instance, in a study of adults diagnosed with major depressive disorder, Brittlebank, Scott, Williams, and Ferrier (1993) found that overgeneral autobiographical memory at baseline accounted for 33% of the variance in depressive symptoms 7 months later. In contrast, neither dysfunctional attitudes nor depressive symptom severity at baseline predicted later depression. Although evidence for the predictive value of such I-P factors is lacking in childhood, there are good reasons to believe they may be important. For example, Lonigan and Phillips (2001) suggested that an attentional bias toward threat cues may mediate the relation between children's temperamental risk and later development of anxiety disorders. As further developed by Lonigan, Vasey, Phillips, and Hazen (2002), this theory predicts that the presence of such an attentional bias is a marker of risk stemming from the combination of temperamental predispositions to both high levels of negative affective reactivity

and low levels of effortful control. Thus, the presence of an attentional bias toward threat cues in childhood may be a useful predictor of risk for the development of anxiety disorders. Although much more research is necessary before firm conclusions can be drawn, Lonigan et al. report preliminary evidence supporting their view.

Overview of Articles in the Special Section

The articles in this special section were selected for several reasons. First, several apply the I-P framework to childhood and adolescent problems that have not previously been approached from that perspective. Specifically, Braet and Crombez (this issue) test the hypothesis that obesity in children and adolescents is associated with biased processing of food stimuli reflecting a preoccupation with food and eating. Also, Loney et al. (this issue) apply the I-P perspective to the study of the processing of emotion-relevant stimuli in relation to psychopathic traits. In both cases, similar research has been conducted previously with adults (yielding very similar results), but these studies are the first in child and adolescent samples.

Second, at least one of the articles focuses on an aspect of I-P that previously has not been examined in children or adolescents. Specifically, de Decker, Hermans, Raes, and Eelen (this issue) demonstrate that, like adults, adolescents exposed to traumatic experiences exhibit overgeneral autobiographical memory (i.e., difficulty recalling specific autobiographical memories).

Third, several of the articles apply new approaches to childhood problems, such as aggression, that have been the subject of past I-P research. Specifically, Orobio de Castro, Slot, Bosch, Koops, and Veerman (this issue) describe an experimental study that was designed to clarify the source of increases in the hostile interpretation bias exhibited by aggressive children when they are exposed to threat of imminent interaction with a hostile peer. Also focusing on the information processing of aggressive children, Schippell et al. (this issue) describe the first study to use a specific measure of selective attention to test the hypothesis that RA, but not PA, should be associated with hypervigilance for stimuli associated with social conflict, rejection, and failure. Also, Dalgleish et al. (this issue) describe a study that simultaneously measured three separate aspects of information processing in children and adolescents with clinical diagnoses of depression, generalized anxiety, and posttraumatic stress disorder. It is rare even in studies of adults for several diagnostic groups to be compared simultaneously on multiple aspects of the I-P system.

Finally, the special section concludes with a critical commentary by Vasey, Dalgleish, and Silverman on

the current state of research on I-P factors in relation to child and adolescent psychopathology, its assessment and its treatment. Vasey et al. (this issue) offer a number of important recommendations for maximizing the value of theory and research regarding I-P factors in clinical child and adolescent psychology.

Summary

In summary, the I-P paradigm is a valuable framework for clinical child and adolescent psychology because it fosters conceptualization of the roles played by cognitive factors in typical and atypical development and fosters empirical tests of such conceptualizations by providing a flexible and powerful methodological toolbox. Measures of I-P factors may additionally prove useful in refining our concepts of disorders by revealing important differences among young people who fall in the same diagnostic category (e.g., the difference between RA and PA in a child meeting criteria for oppositional defiant disorder or conduct disorder). Both of these benefits are clearly illustrated by the empirical articles in this section. Measures of I-P factors may also prove useful for designing and refining treatments and testing the basis for their efficacy. Further, such factors may prove useful for identifying children at risk for the development of psychopathology, poor prognosis, or relapse. However, as noted by Vasey et al. (this issue), the potential clinical value of the I-P paradigm has yet to be demonstrated in child and adolescent samples. Such applications of the I-P perspective are a particularly important direction for future research.

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