Journal of Abnormal Child Psychology, Vol. 12, No. 3, 1984, pp. 471–490

Social Information Processing in Child Psychiatric Populations[1]

Richard Milich[2]
University of Iowa

Kenneth A. Dodge
Indiana University at Bloomington

This study examined three kinds of social information-processing deficits in child psychiatric populations. The deficits studied were response decision biases, hostile attributional biases, and cue-utilization deficiencies. Subjects were diagnosed as hyperactive/aggressive (H/A) (n = 24), exclusively hyperactive (n = 14), exclusively aggressive (n = 14), psychiatric control (n = 23), and normal control (NC) (n = 60) boys according to procedures suggested by Loney and Milich (1982). They were administered several tasks to solicit information-processing patterns. The H/A group was found to be deficient in all three areas asssessed, relative to the NC group. They were also deficient in response decisions and cue-utilization, relative to the other three groups of psychiatrically referred boys. Discriminant function analyses demonstrated that the H/A group displayed a distinct processing pattern. These results were found to be relevant to the study of behavior disorders, to social information processing theory, and to intervention efforts with these boys.

[1] This work was supported by NIMH Grant No. 32992, awarded to the first author, and NIMH Grant No. 37062, awarded to the second author.

[2] Address all correspondence to Richard Milich, Department of Psychiatry, University of Iowa, Iowa City, Iowa 52242.

0091-0627/84/0900-0471$03.50/0

A recent series of studies (summarized in Dodge, in press-a) has consistently found that aggressive boys, identified by classroom peers and teachers, differ from nonaggressive boys in the ways that they process social information. Three kinds of processing differences have been identified in these studies. First, aggressive boys, relative to nonaggressive boys, have been found to generate a higher proportion of aggressive, incompetent solutions in response to hypothetical problem situations (Richard & Dodge, 1982; Rubin & Krasnor, in press), particularly in response to those situations involving an ambiguous provocation by a peer (Dodge, 1980). This processing difference may be called a *response decision bias* among aggressive boys.

Second, Dodge (1980; Dodge & Frame, 1982) has found that this difference in response decisions may occur as a function of differences in children's attributions about the intention of the peer committing the provocation. Under ambiguous provocation circumstances, aggressive boys are more likely than nonaggressive boys to attribute a hostile intent to the peer (Aydin & Markova, 1979; Dodge & Frame, 1982; Steinberg & Dodge, 1983). This *hostile attributional bias* empirically predicts and explains the response decision differences cited earlier (Dodge, 1980). Dodge and Frame (1982) also found that aggressive boys expect peers to continue to act with hostile intent toward them in the future.

A third category of social information processing that differentiates aggressive from nonaggressive boys concerns the manner in which these boys attend to, encode, and utilize social cues in their environment. Dodge and Newman (1981) found that aggressive boys, relative to others, will collect fewer pieces of information about a peer prior to making an attribution about the peer's intention. Dodge and Tomlin (1983) controlled the amount of information presented to subjects and found that the aggressive boys cite fewer pieces of presented information when justifying their attributional decisions than nonaggressive boys. Instead, they cite irrelevant past experiences of their own or characteristics of peers "in general." These findings suggest that aggressive boys are deficient in the utilization of presented cues. Dodge and Tomlin (1983) also found that aggressive boys are particularly deficient in their use of cues that have been presented early in a sequence. That is, when cues are presented in a serial order, aggressive boys place inordinately heavy emphasis on the last cues presented when making an attributional decision. In similar fashion, their recall of early presented cues is deficient in comparison to nonaggressive boys, whereas their recall of later presented cues is not deficient. These findings support the hypothesis of a *cue-utilization deficiency* in aggressive boys.

The three patterns found in these studies suggest a general model of social information processing in aggressive boys (Dodge, in press, b). According to the model, when presented with social cues about peers, ag-

gressive boys demonstrate deficiencies in their perception and encoding of these cues (step 1). These deficiencies lead them to make biased attributions about peers' intentions and to expect that peers will be hostile toward them in the future (step 2). Such a bias leads them to generate and adopt inappropriately aggressive responses to problem situations, particularly when a provocation is involved (step 3). The aggressive behavior by these boys leads peers to reject them. The rejection, in turn, serves to reinforce and perpetuate the deficient and biased processing that the aggressive boys display. The model is one of reciprocal influence among information processing, aggressive behavior, and peer rejection.

Although the reported empirical findings have been used to describe the behavior of aggressive boys, some of the patterns may also fit other diagnostic groups of psychiatrically impaired children. For example, hyperactive children also experience heightened peer rejection (King & Young, 1982; Milich, Landau, Kilby, & Whitten, 1982; Pelham, & Bender, 1982) and peer interaction difficulties (Campbell & Paulauskas, 1979). Hyperactive children also demonstrate some of the information-processing deficits found in aggressive boys, including impulsive responding and inattention to presented cues (Loney & Milich, 1982; Campbell & Cluss, 1982). In fact, attention deficits are now viewed as a defining characteristic of the psychiatric category of hyperactivity (American Psychiatric Association, 1980). Not surprisingly, the behavior of hyperactive children includes a high rate of peer-directed aggression (Campbell & Paulauskas, 1979; Milich & Landau, 1982).

Even though there exists a good deal of overlap between the behavior of hyperactive and aggressive boys, the work of Loney & Milich (Loney, Langhorne, & Paternite, 1978; Milich, Loney, & Landau, 1982) has demonstrated that separable factors of aggressiveness and hyperactivity can be identified in child psychiatric populations. These factors are associated with distinct externalizing behavior patterns (Loney & Milich, 1982) and predict distinct outcomes in adolescence (Milich & Loney, 1979). The DSM-III (American Psychiatric Association, 1980) concurs with this distinction by listing separate diagnostic categories of attention deficit disorder and aggressive conduct disorder. Langhorne and Loney (1979) identified four psychiatric groups of children using these two factors: Exclusively hyperactive, exclusively aggressive, hyperactive/aggressive, and nonhyperactive/nonaggressive.

The goal of this study was to assess social information-processing patterns in these four groups of psychiatrically impaired boys, as well as a nonpsychiatric group. The three types of processing patterns described earlier (response decision biases, hostile attributional biases, and encoding and cue-utilization deficiencies) were assessed, using the same procedures that have been used in the past with school populations.

We hypothesized that cognitive processing deficits would be most pronounced for the combined hyperactive/aggressive (H/A) boys, as described by Langhorne and Loney (1979) and Loney and Milich (1982). Since a reciprocal influence process among cognition, behavior, and peer rejection is hypothesized to mediate these patterns, the clinical group that displays a combination of aggressive behavior and attention deficits should be most likely also to display the social information-processing deficits. A group that displays one symptom but not the other should be less likely to demonstrate the processing deficits. Several lines of evidence exist to support this hypothesized relationship. Previous work has shown that the combined H/A group is significantly more symptomatic than either an exclusively hyperactive or an exclusively aggressive group for many of the behavioral and cognitive deficits studied by Dodge, including impulsivity (Milich, Landau, & Loney, 1981) and attentional difficulties (Milich & Loney, 1980; Roberts, 1979).

A second issue relates to the nature of the aggressive samples investigated by Dodge. In operationalizing his aggressive groups, Dodge has established three criteria: High scores on measures of aggression, low scores on peer popularity nominations, and high scores on peer rejection nominations. Recent work by Milich and Landau (1984) has indicated that the combined hyperactive/aggressive group is most symptomatic of these peer difficulties, including both low popularity and high rejection.

Taken together, this evidence suggests that the aggressive group of boys defined by Dodge and his colleagues would be most comparable to the combined H/A group described and investigated by Loney and Milich (1982). In the present study the information-processing patterns of the H/A group was contrasted with those patterns exhibited by a nonreferred control group, as well as with those patterns exhibited by the remaining clinic sample. In both cases, the possible confounding effects of general intelligence were controlled statistically, in order to allow for an identification of specific social information-processing deficits.

METHOD

Subjects

Clinic Sample. The clinic sample consisted of 75 boys who had been referred to a child psychiatry outpatient clinic and then seen again at follow-up approximately 2 years later. The referral sample ($n = 100$) consisted of all consecutively referred boys who were between the ages of 6 and 12 and not retarded or psychotic, and included boys with a variety of behavior

problems and psychiatric disorders. (See Milich et al., 1982, for a more detailed description of the selection criteria and sample description at referral.) Of the 100 boys seen at referral, 6 had moved out of state and thus could not be seen at follow-up. Another 17 families refused to participate at the follow-up study, resulting in a total sample of 77. Due to procedural errors, the data for 2 boys were discarded, resulting in a final sample of 75 boys.

The 75 boys were divided into four groups, based upon median splits of their scores on empirically derived Hyperactivity and Aggression factors generated at referral. (See Milich et al., 1982, for a description of the generation of these factors, as well as for data supporting the convergent and discriminant validity of each.) The hyperactive/aggressive (H/A; $n = 24$) group is the primary clinical group under investigation. Other clinic groups included exclusively hyperactive (H) boys ($n = 14$), exclusively aggressive (A) boys ($n = 14$), and psychiatric control (PC) boys ($n = 23$).

As noted earlier, it was hypothesized that the H/A boys would be most similar to the aggressive groups as operationalized in the studies undertaken by Dodge. To examine this issue, ratings of peer acceptance and rejection made from the boys' psychiatric charts were analyzed. These ratings were undertaken in a manner similar to that used to generate the Hyperactivity and Aggression factors (see Milich et al., 1982). Effective interrater reliabilities for the ratings of peer acceptance and rejection were .77 and .73, respectively. The H/A group was found to differ significantly from the remaining clinic groups in terms of both peer acceptance, $F(1, 73) = 18.0, p < .001$, and peer rejection, $F(1, 73) = 15.5, p < .001$. The H/A group was rated to be significantly less accepted and significantly more rejected than the other clinic groups. These results indicate that the H/A group, as compared with the rest of the clinic sample, in addition to being high on aggressive behavior, is also high on peer rejection and low on peer acceptance. These criteria make the H/A group similar to the group employed by Dodge in his studies of schoolchildren.

Control Sample. Sixty boys who were randomly selected classmates of the clinic boys at the time of referral also served as subjects. These normal control (NC) boys were seen both at the time of the initial referral and at follow-up, approximately 2 years later. For each clinic boy at referral, letters enlisting participation in the study were sent out to five randomly selected classmates. The letters were worded so that the families would not know that a classmate had been seen at the clinic. If more than one family in a class expressed interest in participating, one was chosen at random. A total of 68 NC subjects were seen during the initial referral phase of the study, and 60 of these were seen at follow-up. None of the NC boys had ever been referred to a clinic for behavior or learning problems.

Procedure

At the follow-up evaluation each of the subjects was seen individually for approximately 3 hours in the morning and 1 hour in the afternoon. Among the tasks completed in the morning were three procedures developed by Dodge in his studies of aggressive boys, as follows:

1. *Hypothetical attribution task* (Dodge, 1980; Dodge & Frame, 1982). Each boy was asked to nominate two male classmates who best fit behavioral descriptions associated with aggression (e.g., who is mean, bossy, hits kids). Each of the two nominated aggressive boys then served as the antagonists in two of four hypothetical stories read to each subject. For each story the subject was asked to imagine that the identified aggressive peer was involved in an activity in which a particular negative outcome occurred to the subject. The four stories involved seeing the aggressive peer holding the subject's pencil, getting hit in the back by a ball thrown by the peer, having the peer spill milk all over the subject's back, and seeing the peer's hand in the subject's lunch bag. After each story the subject was asked six questions—two designed to assess his attributions (which were scored as hostile, benign, or benevolent) concerning the peer's intentions

Table I. Summary of Dependent Variables

Variable no.	Task	Process assessed	Description
1	Hypothetical story	Attributional bias	Attribution of peer's intent (open-ended)
2	Hypothetical story	Attributional bias	Attribution of peer's intent (forced choice)
3	Hypothetical story	Response decision	Behavioral response to provocation
4	Hypothetical story	Response decision	Punishment suggested
5	Hypothetical story	Attributional bias	Expectation of future prosocial behavior
6	Hypothetical story	Attributional bias	Expectation of future aggressive behavior
7	Recall	Encoding	Total items recalled
8	Recall	Encoding	% of hostile items recalled
9	Recall	Encoding	% of benevolent items recalled
10	Recall	Encoding	% of neutral items recalled
11	Recall	Encoding	% of intrusions made
12	Recall	Encoding	% of first items recalled
13	Recall	Encoding	% of last items recalled
14	Detective decision	Encoding	Total testimonials heard
15	Detective decision	Attributional bias	Total judgments of guilt
16	Detective decision	Encoding	Total testimonials recalled
17	Detective decision	Encoding	Ratio of positive to total testimonials recalled
18	Detective decision	Encoding	Proportion of testimonials heard that were recalled

during the event, two designed to assess his expectations about future interactions with the peer (which were scored as peer-aggressive or peer-prosocial), one designed to determine how the subject would react in response to the hypothetical provocation (scored as benevolently, neutrally, or aggressively), and one asking the subject to assign a punishment level to the peer for his provocative behavior. Each of the six questions was summed across the four stories to form the six dependent variables employed in the analyses. (See Table I for a summary of these variables.) Four variables (Nos. 1, 2, 5, and 6) assessed hostile attributional biases, and two variables (Nos. 3 and 4) assessed response decision biases.

2. *Recall task* (Dodge & Frame, 1982). Each subject listened to nine audiotaped interviews, one at a time, each consisting of a different unknown peer describing nine different behaviors that he displayed toward peers in his class (e.g., I let Eddie read my new comic book), equally divided among benevolent, neutral, and hostile acts. Order of presentation was systematically varied across the subjects. At the end of each interview stimulus the subject was asked to recall as many of the statements in the stimulus as possible. The dependent variables consisted of the total number of statements correctly recalled (No. 7), as well as the proportions of hostile (No. 8), benevolent (No. 9), and neutral statements (No. 10) correctly recalled. A further dependent variable was the proportion of intrusions (false positives) made (No. 11), that is, the proportion of statements recalled by the subject that had not been presented. These intrusions usually consisted either of statements recalled from previous interviews or of statements that were misrecalled or contained major distortions (e.g., transforming a neutral statement into an aggressive act). Finally, the proportions of the total number of first items (No. 12) and last items (No. 13) that appeared in the stimulus that were correctly recalled were each computed. This procedure resulted in seven dependent variables, each of which was designed to assess some aspect of encoding or cue-utilization deficiencies.

3. *Detective decision task* (Dodge & Newman, 1981). Each subject was presented, one at a time by audiotape, six ambiguous hypothetical stories in which a peer may have committed a certain hostile act toward the subject (e.g., knocking over his bike). At the end of each story, the subject was given the opportunity to listen to from one to four boys present eyewitness testimonials on audiotape about the peer and what happened. In each testimonial, the boy presented one exonerating piece of evidence (e.g., I thought I saw John on the other side of the parking lot when the bike fell) and one condemning piece of evidence (e.g., I saw John standing over your bike laughing). The subject listened to as many testimonials as he desired and then decided whether the peer was guilty or not of committing the hostile act. After each decision the subject was asked to recall as many as possible of the testimonials that he heard. The dependent variables con-

sisted of the number of testimonials listened to before deciding (No. 14), the subject's judgment about the guilt or innocence of the peer (No. 15), the number (No. 16), and type (i.e., prosocial or hostile, No. 17) of testimonials recalled after deciding, and the proportion of testimonials heard that were recalled (No. 18). All measures were summed across the six stories. During this task the boys were given the opportunity to earn money. They were told that for each story for which they correctly determined guilt or innocence they would win $.50. Feedback was given only at the end of the six stories, and all of the boys were told they were correct on all of the stories. This task resulted in five dependent variables, four of which assessed encoding and cue-utilization deficiencies (the number of testimonials heard, the number of testimonials recalled, the proportion of testimonials heard that were recalled, and the proportion of hostile testimonials recalled) and one of which assessed a hostile attributional bias (the decision of guilt).

Finally, age and intelligence (WISC-R Full Scale IQ) information were collected on each subject, the latter at referral only.

RESULTS

Analyses were undertaken in five stages. First, the H/A group was compared with the normal control (NC) sample for each of the three experimental procedures. These analyses addressed the question of whether the H/A group exhibits processing patterns similar to those of the aggressive boys in the Dodge studies. Next, discriminant function analyses were performed to assess the overall power of the dependent variables in discriminating these groups. Third, the H/A group was contrasted with the remaining clinic sample. These analyses were undertaken to determine whether any biases or deficits that may exist are unique to the H/A group or, instead, are associated with clinic-referred boys in general. In the fourth stage, discriminant function analyses assessed the power of the dependent variables in discriminating among the psychiatric groups. Finally, discriminant function analyses were used to distinguish among H/A, other psychiatric, and NC subjects.

HA versus NC Comparisons

Analyses compared the H/A and NC groups on demographic variables. There was no significant difference between the H/A (M = 11.8) and NC (M = 11.5) groups in age, $t(82) = .72$, n.s., but the two groups did differ significantly in WISC-R Full Scale IQ (M of H/A = 94, M of NC = 110), $t(82) = 6.5$, $p < .01$. In all ensuing analyses the possible effects of

these IQ differences were controlled through the use of analyses of covariance (ANCOVA). These analyses were also undertaken controlling for the effects of age. The results obtained were virtually identical to those reported here.

The groups' means and standard deviations for all dependent variables are found in Table II. The first set of ANCOVAs consisted of examining H/A and NC group differences on the five variables assessing hostile attributional biases. When asked in an open-ended manner to attribute an explanation to the peer's behavior in the hypothetical stories task (variable No. 1), the H/A group was significantly more likely to attribute hostile intent to the peer than was the NC group, $F(1, 81) = 5.99$, $p < .05$. When asked a similar question (No. 2) in a forced-choice format (e.g., "on purpose" vs. "by accident"), the two groups did not differ significantly, $F(1, 81) < 1$. In the same task, there was a marginally significant tendency for the H/A group to be more likely to predict that the peer would act in a hostile manner in the future than the NC group (No. 6), $F(1, 81) = 3.30$, $p = .07$. The two groups did not differ when they were asked to predict whether the peer would act in a prosocial manner in the future (No. 5), $F(1, 81)$ $p < 1$. Finally, there was no significant difference between the groups in the detective decision task when they were asked to judge the peer as guilty or innocent (No. 15), $F(1, 81) < 1$.

The H/A and NC groups were next compared on the two variables that assessed response decision biases. In the hypothetical stories task, when asked in an open-ended manner to decide how they would respond to the ambiguous provocation by the peer (No. 3), the H/A group was significantly more likely than the NC group to respond aggressively, $F(1, 81) = 4.70$, $p < .05$. However, when given response alternatives as to how much punishment the peer should receive (No. 4), the two groups did not differ significantly, $F(1, 81) < 1$.

Eleven variables assessed encoding and cue-utilization deficits and biases. One of the variables assessed voluntary attention to cues (No. 14). In the detective decision task, the H/A group displayed a marginally significant tendency to choose to hear fewer testimonial cues than the NC group prior to making an attributional decision (No. 14), $F(1, 81) = 3.1$, $p = .08$. The other 10 variables assessed aspects of recall of cues. On the recall task, the H/A group recalled significantly fewer cues than did the NC group (No. 7), $F(1, 81) = 9.1$, $p < .01$. Likewise, on the detective decision task, the H/A group recalled significantly fewer testimonial cues than the NC group (No. 16), $F(1, 81) = 10.3$, $p < .01$. However, the latter measure is biased because the H/A group actually heard fewer cues than the NC group. When the proportion of all cues presented that were correctly recalled was assessed (No. 18), the two groups did not differ, $F(1, 81) < 1$. Even though the H/A

Table II. Means and Standard Deviations of the Dependent Variables for the Five Clinic Groups

	Normal controls		Hyperactive/ aggressive		Exclusively hyperactive		Exclusively aggressive		Psychiatric controls	
Dependent variable	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
Full Scale IQ	109.9	(11.10)	94.0	(8.2)	99.4	(10.2)	102.6	(13.9)	100.1	(13.6)
Age at follow-up	11.6	(1.67)	11.8	(1.7)	12.2	(1.9)	12.1	(1.6)	11.8	(1.6)
Hypothetical stories[a]										
1. Intent (open-ended)	6.58	(1.41)	6.96	(1.23)	6.93	(1.07)	6.36	(1.21)	7.00	(1.00)
2. Intent (forced choice)	7.43	(1.29)	7.92	(1.31)	7.50	(1.34)	7.93	(.99)	7.48	(1.24)
3. Behavioral response	5.28	(1.34)	5.92	(1.21)	5.43	(1.02)	5.36	(1.22)	5.48	(1.62)
4. Punishment	11.23	(1.58)	10.79	(1.50)	11.42	(1.09)	11.57	(1.45)	10.96	(1.64)
5. Future prosocial behavior	6.98	(1.00)	6.54	(1.50)	7.21	(.89)	6.29	(1.20)	6.74	(1.10)
6. Future aggressive behavior	7.17	(1.14)	6.67	(1.27)	6.36	(1.28)	7.07	(1.07)	7.17	(1.37)
Recall task										
7. Total items recalled	37.3	(7.6)	30.9	(8.1)	36.0	(8.9)	34.7	(9.1)	33.4	(9.6)
8. % of hostile items recalled	.44	(.08)	.46	(.07)	.45	(.08)	.46	(.08)	.44	(.06)
9. % of benevolent items recalled	.35	(.08)	.39	(.07)	.35	(.06)	.35	(.06)	.35	(.04)

10. % of neutral items recalled	.20	(.06)	.16	(.05)	.20	(.06)	.19	(.06)	.21(.06)
11. % of intrusions made	.04	(.06)	.09	(.15)	.05	(.06)	.05	(.03)	.07(.09)
12. % of first items recalled	.09	(.04)	.09	(.03)	.08	(.03)	.09	(.03)	.09(.04)
13. % of last items recalled	.19	(.06)	.23	(.07)	.21	(.07)	.21	(.06)	.22(.07)
Detective game									
14. Total testimonials listened to	16.8	(5.2)	12.0	(6.2)	15.6	(6.3)	14.8	(4.5)	15.0 (6.7)
15. Total guilty judgments	3.6	(1.3)	3.4	(1.44)	3.8	(1.5)	3.8	(1.3)	3.3 (1.2)
16. Total testimonials recalled	16.5	(4.5)	10.74	(4.1)	15.6	(6.1)	14.9	(3.1)	14.6 (6.0)
17. Ratio of positive to total testimonials recalled	.42	(.10)	.40	(.11)	.41	(.12)	.38	(.11)	.42 (.13)
18. The proportion of testimonials heard that was recalled	1.03	(.29)	.98	(.38)	1.05	(.15)	1.04	(.31)	1.02 (.24)

[a]Hypothetical stories: (1) Intent (open-ended)—higher scores associated with greater aggressive attribution; (2) intent (forced choice)—lower scores associated with aggressive attribution; (3) behavioral response (open-ended)—higher scores associated with more aggressive response; (4) punishment (forced choice)—lower scores associated with more aggressive punishment; (5) prediction of future prosocial behavior—lower scores associated with prosocial prediction; (6) prediction of future aggressive behavior—lower scores associated with aggressive prediction.

group displayed over twice as many intrusions into recall as the NC group (No. 11), this difference was not significant, $F(1, 81) = 2.0$, $p = .17$.

Several variables assessed subjects' biases in recall according to the content of the cues. On the recall task, the H/A group was found to recall significantly fewer neutral cues than the NC group (No. 10), $F(1, 81) = 8.5$, $p < .01$. The groups did not differ in the proportion of hostile cues recalled on that task (No. 8), $F(1, 81) < 1$, and a tendency was found in the direction of the H/A group recalling more benevolent cues than the NC group (No. 9), $F(1, 81) = 2.9$, $p < .10$. In other words, the H/A group's recall deficits were largely due to failure to recall nonvalenced, neutral cues. In the detective decision task, the groups did not differ in terms of the ratio of exonerating to total cues recalled (No. 17), $F(1, 81) < 1$.

Finally, two variables assessed subjects' biases in recall according to the order of cues presented. Consistent with previous research (Dodge & Tomlin, 1983), on the recall task, even though the H/A group recalled fewer cues overall than the NC group (see above), the proportion of the last cues recalled was actually greater than that of the NC group (No. 13), $F(1, 81) = 5.7$, $p < .01$. The groups did not differ in the proportion of recall of the first items presented (No. 12), $F(1, 81) < 1$. In summary, evidence was found in support of the hypothesis that the H/A group would display biases or deficits, relative to the NC group, in each of the three categories of information processing examined, namely, hostile interpretive biases, response decision biases, and encoding biases and deficits.

Discriminant Function Analyses Comparing the HA and NC Groups

To investigate the power of the social information-processing variables to discriminate between the H/A and NC groups, discriminant function analyses were performed in which group membership was predicted in a hierarchical stepwise fashion from the dependent variables. These analyses revealed that five of the variables contributed unique and significant information to the prediction of group membership (Nos. 1, 6, 7, 10, and 14). These variables were the attribution of hostile intention, the expectation of future aggressive behavior, the total number of items recalled, the percentage of neutral items recalled, and the total number of testimonials heard. This analysis correctly classified 82.5% of the subjects. When IQ was added to this analysis, 88.75% of the subjects were correctly classified. Of the H/A sample, 82.6% were correctly classified, while 91.2% of the NC sample were correctly classified. The statistical analysis revealed a highly significant prediction of group membership from the five variables and IQ, $F(6, 73) = 14.29$, $p < .001$.

H/A versus Clinic Comparisons

The same analyses were conducted as before, this time with a comparison of the H/A group to the rest of the psychiatric clinic sample (the H, A, and PC groups combined). The groups did not differ in age, $t(73) = .38$, n.s., but did differ in IQ, with the H/A group having a lower mean score than the rest of the clinic sample, $t(73) = 2.4$, $p < .05$. As before, in all ensuing analyses IQ was controlled through the use of ANCOVAs.

Of the analyses assessing hostile attributional biases, none yielded significant differences. Of the analyses assessing response decision biases, one yielded a marginal effect. In the hypothetical stories task, there was a tendency for the H/A group to be more likely to decide in an open-ended manner that they would respond aggressively to a provocation by a peer than the rest of the clinic sample (No. 3), $F(1, 72) = 3.5$, $p = .07$. Of the analyses assessing encoding deficits and biases, four yielded significant differences. The H/A group chose to attend to fewer testimonial cues on the detective decison task than did the rest of the psychiatric sample (No. 14), $F(1, 72) = 7.32$, $p < .01$. The H/A group also recalled significantly fewer testimonial cues than did the rest of the clinic sample on this task (No. 16), $F(1, 72) = 7.3$, $p < .01$. However, there was no difference in the proportion of all cues presented that was recalled (No. 18), $F(1, 72) < 1$. On the recall task, the H/A group recalled a significantly smaller proportion of neutral cues than the rest of the clinic sample (No. 10), $F(1, 72) = 11.2$, $p < .01$, while they recalled a higher proportion of the benevolent cues (No. 9), $F(1, 72) = 9.8$, $p < .01$.

Discriminant Function Analyses Comparing the H/A and Psychiatric Groups

Discriminant function analyses were performed in which group membership (H/A vs. the rest of the psychiatric sample) was predicted from the dependent variables in a hierarchical stepwise fashion. These analyses revealed that four variables added unique and significant information to the prediction of group membership: The likelihood of responding aggressively to a provocation, the percentages of both neutral and benevolent items recalled, and the total number of testimonials listened to before deciding in the detective task (Nos. 3, 9, 10, and 14). This analysis correctly classified 77.5% of the subjects, with a significant prediction of group membership, $F(4, 66) = 6.28$, $p < .01$. Of the H/A group, 89.6% were correctly classified, whereas for the rest of the psychiatric sample only 52.2% were correctly classified. These data suggest that social information-processing

Table III. Prediction of Group Membership by Discriminant Function Analyses

	Predicted group membership[a]		
	Normal control	Hyperactive/ aggressive	Other psychiatric
Actual group memership			
Normal control (n = 57)	39 (68.4%)	2 (3.5%)	16 (28.1%)
Hyperactive/aggressive (n = 23)	1 (4.3%)	13 (56.5%)	9 (39.1%)
Other psychiatric (n = 48)	16 (33.3%)	7 (14.6%)	25 (52.1%)

[a]Prediction is based on only three dependent variables (Nos. 6, 10, and 14), consisting of the prediction of future aggressive behavior, the percentage of neutral items recalled, and the total number of testimonials listened to, along with IQ.

biases and deficits were highly sensitive to the identification of the H/A members as part of an impaired group but also "overselected" a high proportion of other psychiatric clinic subjects as impaired. When IQ was added to this analysis, not one subject changed classification.

Discriminant Function Analyses Distinguishing among NC, HA, and Other Psychiatric Clinic Subjects

The final analyses were discriminant functions predicting the distinctions in group membership among NC, H/A, and the other psychiatric clinic subjects. Three variables (Nos. 6, 10, and 14) added unique and significant information to this prediction, and 52.2% of the subjects were correctly classified, $F(6, 246) = 6.82$, $p < .001$. These variables consisted of the prediction of future aggressive behavior, the percentage of neutral items recalled, and the total number of testimonials listened to in the detective decision task. When IQ was added to the prediction, 60.2% of subjects were correctly classified, $F(8, 244) = 8.40$, $p < .001$. F tests of the comparisons of each pair of groups indicated that each group was significantly and uniquely predicted by these variables (all Fs greater than 6.8, $p < .01$). Table III indicates that the NC group was the most distinct of all the groups, with 68.4% of those subjects being correctly classified. Also, the H/A group was highly distinct from the NC group, with only three subjects in those two groups (3.8%) being misclassified into the other group. Of the 51 misclassifications, the majority (62.7%) consisted of subjects in the NC and the non-H/A psychiatric groups being misclassified into the other group.

DISCUSSION

We examined the unique cognitive patterns displayed by several diagnostic groups of psychiatrically referred boys and a normal control group, using measures of three kinds of social information processing that have been related in the past to deviant behavior in normal populations. As hypothesized, the group of boys diagnosed as "hyperactive/aggressive" (H/A) emerged as distinct from the normal boys and distinct from the other psychiatrically referred boys, findings relevant both to social information processing theory and to research in child psychiatric disorders.

The specific findings may be summarized as follows: In encoding and cue-utilization, the H/A boys were found to be deficient in their attention to relevant social cues. They voluntarily attended to fewer cues prior to making an attributional decision than all other groups. This lack of attention to cues by the H/A group is similar to the pattern displayed by socially rejected, aggressive boys in a school setting (Dodge & Newman, 1981). According to social information-processing theory, such a deficit should render these boys likely to make subsequent errors in their processing of social information, since the pool of information on which they must base their attributional and response decisions is necessarily smaller than the pool available to other boys. Even when presented with the same number of cues as other boys, the H/A boys were found to recall fewer cues than normal and other psychiatrically referred boys. This finding is not due to differences in overall intelligence among the groups, since WISC-R Full Scale IQ scores were used as a covariate in these analyses. This finding is further support for the hypothesis that the H/A boys have a specific deficit in their encoding and recall of social cues.

The nature of the social information-processing deficits noted for the H/A boys may be due to one or more cognitive mechanisms, including attentional difficulties and/or impulsivity. Although it is often difficult to disentangle these two processes (see Pelham, 1982), there appeared to be evidence that both may have been operative. For example, the H/A boys exhibited deficits both when they were allowed to respond rapidly (e.g., in the detective decision task) and when they were required to attend to all of the stimulus material before responding (e.g., in the hypothetical stories and recall tasks). Whether impulsivity, attentional difficulties, or some third process specifically accounted for the deficits exhibited by the H/A boys cannot be determined from the present data.

The recall deficit among the H/A boys was limited to neutral cues. Since neutral cues are less sensational than hostile and benevolent cues, the H/A boys, having a limited working memory, may fail to attend to them as

strongly as to other cues. This inference must be expressed with caution since recall is at best an indirect measure of attention. The H/A boys also were more likely than others to recall the most recently presented cues, at the cost of recall of cues presented to them earlier, a finding similar to those of Dodge and Tomlin (1983) with aggressive rejected boys and girls, of Frame and Oltmanns (1982) with adult schizophrenics, and of Harvey, Winters, Weintraub, and Neale (1981) with children vulnerable to psychopathology. Dodge and Tomlin showed that such a "recency emphasis" makes it likely that these boys will often make impulsive and inaccurate interpretations and response decisions.

The second category of social information processing assessed was biases in boys' interpretation of social cues. The H/A boys were more likely than normal control boys to attribute hostile intentions to peers, following an ambiguous provocation by the peer, and were also more likely to expect that the peer would continue to behave in a hostile manner in the future. These findings are similar to those found in work with aggressive populations (Aydin & Markova, 1979; Dodge, 1980; Nasby, Hayden, & DePaulo, 1979). It is interesting to note that the attributional bias found among the H/A boys did not differ from a similar bias found in the other psychiatrically referred boys. This phenomenon may be a more general pattern that exists among children with behavioral or psychiatric disorders than originally thought. It is also noteworthy that this bias was not evident when boys were given a forced-choice attributional task. Only when they were asked in an open-ended manner to explain the peer's behavior was the bias found. Renshaw and Asher (1983) also reported a difference between open-ended and closed-ended questions in a study of social goals with popular and unpopular children. It may be that the attributional bias found in the present study occurs as a function of highly salient schemas (Abelson, 1976) present among H/A boys. When other alternatives are made salient (as in a forced-choice task), the bias disappears. This restriction on the attributional bias phenomenon adds to our understanding of social information-processing theory and also may suggest ways of intervening to alter such biases in this population. The intervention would consist of making other (benign) interpretations of provocations more salient to these children.

The third category of social information processing was boys' decisions about how they would respond behaviorally to an ambiguous provocation. The H/A boys were 60% more likely than normal control boys and other psychiatrically referred boys to decide that they would retaliate aggressively against the peer instigator of the provocation. This finding is similar to that of Dodge and Frame (1982) with aggressive, rejected boys, and dramatically points toward one of the major social difficulties that this group must experience. As pointed out by Dodge (in press, a), this

aggressive response will most likely be met with disdain by normal peers who have viewed the original provocation as benign and the retaliation by the H/A boys as unjustified.

Implications for the Study of Behavior Disorders

Recent studies by Loney and Milich (1982), Ledingham (1981), and Milich and Landau (1984) have led to the identification of a particular diagnostic group of boys who are at high risk for later behavioral and psychiatric difficulties. These boys are simultaneously hyperactive and aggressive with peers, and socially rejected by peers. The present research demonstrates that this group displays a unique, deviant pattern of processing social information under standardized conditions. The pattern not only differs from that of normal control boys, it is also distinct from that of other psychiatrically referred boys, although the difference is not as great. This work provides further validation of the distinctiveness of this diagnostic category. It also provides some clues as to the cognitive mechanisms that may play an important role in the development and exacerbation of this disorder. How these cognitive processes interact with the behavioral problems of hyperactivity and aggression is not clear from this correlational study, however. Dodge (in press, a) has proposed a reciprocal influence model of the relationships among cognitive biases and deficits, behavioral deviance, and peer rejection. The present findings are consistent with this view in that they demonstrate that these phenomena co-occur.

Implications for Social Information-Processing Theory and Intervention

While the empirical differences among diagnostic groups in this study were statistically significant for several of the information-processing variables, it must be noted that the magnitude of any single finding was small. The problem of "small-magnitude effects" has long plagued researchers seeking to understand the etiology of disorders and clinicians hoping to design effective interventions. Our research, however, has demonstrated that a combination of measures theoretically derived from a social information-processing model could have great power in discriminating diagnostic groups of boys. Of the 23 hyperactive/aggressive boys, only 1 displayed a pattern similar to that of the majority of normal control boys (see Table III). Likewise, only 2 of 57 normal control boys responded like the majority of the H/A boys. This study is one of the few to demonstrate such a strong relationship between social cognitive variables

and behavioral status, providing support for the general hypothesis that a component approach to the assessment of social information processing will have broad predictive power.

One implication for clinicians is that a comprehensive assessment of the way that a child processes social information will yield significant diagnostic information that can be used in designing an individually tailored intervention program. Identification of a child's specific deficits in social information processing, be they encoding deficits, attributional biases, or response decision biases, could lead to appropriate interventions. Of course, the efficacy of such interventions has yet to be demonstrated. The present research, however, should serve to focus the future efforts of clinicians on the particular processes of encoding, interpretation, and response decisions in their behaviorally disordered child clients.

REFERENCES

Abelson, R. P. (1976). Script processing in attitude formation and decision making. In J. S. Carroll & J. W. Payne (Eds.), *Cognition and social behavior.* Hillsdale, New Jersey: Erlbaum.

American Psychiatric Association (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, D.C.: Author.

Aydin, O., & Markova, L. (1979). Attribution tendencies of popular and unpopular children. *British Journal of Social and Clinical Psychology, 18,* 291-298.

Campbell, S. B., & Cluss, P. (1982). Peer relationships of young children with behavior problems. In K. H. Rubin & H. A. Ross (Eds.), *Peer relationships and social skills in childhood* (pp. 323-351). New York: Springer-Verlag.

Campbell, S. B., & Paulauskas, S. (1979). Peer relations in hyperactive children. *Journal of Child Psychology and Psychiatry, 20,* 233-245.

Dodge, K. A. (1980). Social cognition and children's aggressive behavior. *Child Development, 51,* 162-170.

Dodge, K. A. (in press-a). Attributional bias in aggressive children. In P. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy* (Vol. 4). New York: Academic Press.

Dodge, K. A. (in press-b). A social information processing model of social competence in children. In M. Perlmutter (Ed.), *Minnesota symposium on child psychology,* Vol. 18). Hillsdale, New Jersey: Erlbaum.

Dodge, K. A., & Frame, C. L. (1982). Social cognitive biases and deficits in aggressive boys. *Child Development, 53,* 620-635.

Dodge, K. A., & Newman, J. P. (1981). Biased decision making processes in aggressive boys. *Journal of Abnormal Psychology, 90,* 375-379.

Dodge, K. A., & Tomlin, A. (1983). *The role of cue-utilization in attributional biases among aggressive children.* Unpublished paper, Indiana University.

Frame, C. L., & Oltmanns, T. F. (1982). Social recall by schizophrenic and affective patients during and after psychotic episodes. *Journal of Abnormal Psychology, 91,* 311-318.

Harvey, P., Winters, K., Weintraub, S., & Neale, J. M. (1981). Distractibility in children vulnerable to psychopathology. *Journal of Abnormal Psychology, 90,* 298-304.

King, C., & Young, R. D. (1982). Attentional deficits with and without hyperactivity: Teacher and peer perceptions. *Journal of Abnormal Child Psychology, 10,* 483-496.

Langhorne, J. E., & Loney, J. (1979). A four-fold model for subgrouping the hyperkinetic/MBD syndrome. *Child Psychiatry and Human Development, 9,* 153-159.

Ledingham, J. (1981). Developmental patterns of aggressive and withdrawn behavior in childhood: A possible method for identifying preschizophrenics. *Journal of Abnormal Child Psychology, 9,* 1-22.

Loney, J., Langhorne, J. E., & Paternite, C. F. (1978). An empirical basis for subgrouping the hyperkinetic/minimal brain dysfunction syndrome. *Journal of Abnormal Psychology, 87,* 431-441.

Loney, J., & Milich, R. (1982). Hyperactivity, inattention, and aggression in clinical practice. In M. Wolraich & D. Routh (Eds.), *Advances in developmental and behavioral pediatrics* (Vol. 2, pp. 113-147). Greenwich, Connecticut: JAI Press.

Milich, R., & Landau, S. (1982). Socialization and peer relations in hyperactive children. In K. D. Gadow & I. Bialer (Eds.), *Advances in learning and behavioral disabilities* (Vol. 1, pp. 283-339). Greenwich, Connecticut: JAI Press.

Milich, R., & Landau, S. (1984). A comparison of the social status and social behavior of aggressive and aggressive/withdrawn boys. *Journal of Abnormal Child Psychology, 12,* 277-288.

Milich, R., Landau, S., Kilby, G., & Whitten, P. (1982). Preschool peer perceptions of the behavior of hyperactive and aggressive children. *Journal of Abnormal Child Psychology, 10,* 497-510.

Milich, R., Landau, S., & Loney, J. (1981). *The interrelationships among hyperactivity, aggression, and impulsivity.* Paper presented at the annual meeting of the American Psychological Association, Los Angeles.

Milich, R., & Loney, J. (1979). The role of hyperactive and aggressive symptomatology in predicting adolescent outcome among hyperactive children. *Journal of Pediatric Psychology, 4,* 93-112.

Milich, R., & Loney, J. (1980). Hyperactivity, aggression, and inattention in referrals to an outpatient clinic. In J. Loney (Chair), *Childhood hyperactivity: Issues across the ages.* Paper presented at the 88th Annual Meeting of the American Psychological Association, Montreal.

Milich, R., Loney, J., & Landau, S. (1982). Independent dimensions of hyperactivity and aggression: A validation with playroom observation data. *Journal of Abnormal Psychology, 91,* 183-198.

Nasby, W., Hayden, B., & DePaulo, B. M. (1979). Attributional bias among aggressive boys to interpret unambiguous social stimuli as displays of hostility. *Journal of Abnormal Psychology, 89,* 459-468.

Pelham, W. E. (1982). Childhood hyperactivity: Diagnosis, etiology, nature, and treatment. In R. Gatchel, A. Baum, & J. Singer (Eds.), *Clinical psychology and behavioral medicine: Overlapping disciplines* (pp. 261-327). Hillsdale, New Jersey: Erlbaum.

Pelham, W. E., & Bender, M. E. (1982). Peer interactions of hyperactive children: Assessment and treatment. In K. D. Gadow & I. Bialer (Eds.), *Advances in learning and behavioral difficulties* (pp. 365-436). Greenwich, Connecticut: JAI Press.

Renshaw, P. D., & Asher, S. R. (1983). Social knowledge and sociometric status: Children's goals and strategies for social interaction. *Merrill-Palmer Quarterly, 29,* 353-375.

Richard, B. A., & Dodge, K. A. (1982). Social maladjustment and problem solving in school-aged children. *Journal of Consulting and Clinical Psychology, 50,* 226-233.

Roberts, M. A. (1979). *A behavioral method for differentiating hyperactive, aggressive, and hyperactive plus aggressive children.* Unpublished doctoral dissertation, University of Wisconsin-Madison.

Rubin, K. H., & Krasnor, L. R. (in press). Social-cognitive and social behavioral perspectives on problem-solving. In M. Perlmutter (Ed.), *Minnesota symposium on child psychology,* (Vol. 18). Hillsdale, New Jersey: Erlbaum.

Steinberg, M. D., & Dodge, K. A. (1983). Attributional bias in aggressive adolescent boys and girls. *Journal of Social and Clinical Psychology, 1,* 112-121.