The Relationship Between Executive Attention and Dissociation in Children

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SUMMARY. Dissociation involves disruption in the usually integrated functions of consciousness, memory, identity, and perception. Recent research with adults suggests that dissociation is associated with alterations in attention. Little work, however, has examined the attentional correlates of dissociation in childhood. This study is the first to investigate the specificity of cognitive functions related to dissociation in children. Twenty-four 5- to 8-year-old foster children completed several subtests of the NEPSY: A Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1998) in the Executive Functioning/ Attention domain. Foster caregivers completed the Child Dissociative Checklist (Bernstein & Putnam, 1986). Consistent with the adult

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literature, higher levels of childhood dissociation were associated with deficits in tasks requiring inhibition, but not with tasks requiring primarily planning, strategy, or multiple rule sets. doi:10.1300/J229v07n04_08

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Dissociation involves a disruption in the usually integrated functions of consciousness, memory, identity, and perception (American Psychiatric Association, 2000). Dissociation often emerges during early childhood (Putnam, 1997) and is more common among individuals with a history of trauma or childhood abuse (Putnam, 1997; Silberg, 1998; Macfie, Cicchetti & Toth, 2001). Among abused children, dissociative behaviors can be adaptive as they might allow the child to maintain an appropriate and necessary attachment relationship with an abusive caregiver (Freyd, 1996). However, these same dissociative strategies, if not under conscious control, can be maladaptive for children in academic and other domains. One challenge for research on dissociation is to identify the cognitive correlates of dissociation early in development. Understanding specific cognitive processes that facilitate dissociation may guide differential diagnosis between dissociative and other disorders (e.g., Attention Deficit, Hyperactivity Disorder, ADHD), as well as provide leverage points for intervention efforts to facilitate successful functioning in non-threatening contexts.

While dissociation is well-described and identified in the literature, only a handful of studies have sought to empirically investigate the etiology (e.g., Macfie, Cicchetti & Toth, 2001) and cognitive mechanisms of dissociation (DePrince & Freyd, 1999, 2001, 2004; Dorahy, Middleton & Irwin, 2004; Dorahy, Irwin & Middleton, 2002; Elzinga, de Beurs, Sergeant, van Dyck, & Phaf, 2000). It is clearly established that there is a greater likelihood of finding dissociation in maltreated rather than in nonmaltreated children (e.g., Macfie et al., 2001; Putnam, 1997). Given the proposition that trajectories to pathological dissociation are established in childhood, close examination of specific cognitive correlates of dissociation in childhood should inform understanding of the developmental etiology of dissociation. Given that dissociation of-

ten develops in maltreated children, studying these cognitive correlates in foster children seems a good place to start. Cognitive inhibition is of particular interest in the literature review that follows. Cognitive inhibition encompasses a variety of tasks and constructs which have in common the ability to consciously exclude unwanted thoughts or stimuli.

In the last decade researchers have begun to examine cognitive correlates of dissociation using experimental and neuropsychological methods. This research has been conducted with college students (e.g., DePrince & Freyd, 1999) as well as individuals diagnosed with disorders associated with pathological levels of dissociation, including Dissociative Identity Disorder (DID; e.g., Dorahy et al., 2002) and Borderline Personality Disorder (BPD; e.g., Posner, Rothbart, Vizueta et al., 2002; see van der Hart, van der Kolk & Boon, 1998 and Wildgoose, Waller, Clarke, & Reid, 2000 for a discussion of the relationship between dissociation and BPD). Freyd et al. (1998) found that high dissociators in a college sample had increased interference during a color Stroop task (i.e., naming the color of ink used to print conflicting color words, as in the word 'green' written in blue ink). This suggests that high dissociators have greater difficulty inhibiting a task-irrelevant stimulus feature associated with a highly automatic response. Similarly, Dorahy et al. (2002) found weakened cognitive inhibition among patients diagnosed with DID in a negative priming experiment using words as stimuli; however, follow-up work has not found the same impairment when single digit numbers are used as stimuli (Dorahy et al., 2002, 2004). Posner and colleagues (Posner et al., 2002) also found evidence for weakened inhibition mechanisms in a group of sexually abused patients with Borderline Personality Disorder (BPD). These patients showed increased interference during a flanker task, in which participants indicated the direction a central arrow pointed while ignoring nearby, distracting arrows that could point in the same or opposite direction.

Taken together, these studies suggest that higher levels of dissociation are associated with deficits in the attentional mechanism of inhibition. Although the mechanism of inhibition has appeared under several different labels (e.g., conflict resolution, inhibitory control, interference-resolution, and executive control), tasks requiring either the suppression of a prepotent response or resistance to distracter interference have been considered part of the common construct of cognitive inhibition (Fan, Flombaum, McCandliss, Thomas, & Posner, 2003; Friedman & Miyake, 2004). Neuroimaging studies of diverse tasks requiring cog-

nitive inhibition (e.g., Stroop, flanker, and go/no-go tasks) indicate a common set of overlapping brain regions involved across tasks, including the anterior cingulate and areas of prefrontal cortex, amidst large areas of task-specific activations (Fan et al. 2003; Jonides & Nee, 2004; Sylvester, Wager, Jonides, Lacey, Cheshin, & Nichols, 2003). Although the construct of inhibition itself is recognized as being non-unitary (e.g., Fan et al., 2003; Friedman & Miyake, 2004), it remains a useful way of describing a broad class of tasks.

In other attention domains, evidence suggests that high dissociators may be at a cognitive advantage relative to low dissociators. For example, DePrince and Freyd (1999) studied Stroop performance in a divided attention condition in which participants named the ink color while also studying the presented words in preparation for a memory test at the task's end. DePrince and Freyd reported a crossover interaction such that high dissociators showed greater Stroop interference under the typical selective attention condition, in which only the ink color was named, but reduced interference under divided attention conditions relative to low dissociators. This interaction suggested that high dissociators may be at a cognitive advantage under greater attentional load. Dorahy, Irwin, and Middleton (2004) summarized these findings with the suggestion that dissociation may mitigate the negative effects that increased demand on working memory would otherwise be expected to have on divided attention performance. Alternatively, de Ruiter and colleagues (this volume) offered the suggestion that high dissociators may benefit when cognitive task demands are high or more challenging.

In reviewing the child literature we were unable to identify any research examining dissociation in relation to performance on a neuropsychological assessment battery. However, Rogosch and Cicchetti (2005) used a children's version of the flanker task with a large group of children (N = 300) who had a range of maltreatment history and BDP characteristics to demonstrate that history of maltreatment did not influence flanker task performance. Interestingly, higher levels of BDP characteristics related to more interference (i.e., poorer inhibition of the flanking stimuli). Although dissociation was not directly measured in this study, the strong positive correlation between dissociation and BPD (e.g., van der Hart et al., 1996) suggests inhibitory mechanisms may also be deficient in highly dissociative children.

Attention condition has also been used to examine children's memory as a function of dissociation and trauma experience. Preschool children's memory for neutral and threat-related storybook pictures in either selective or dual attention conditions (Becker-Blease, Freyd &

Pears, 2004) was examined as a function of dissociation and maltreatment. In this study, abused/high dissociation children showed impaired recognition memory for threat-related pictures (relative to neutral pictures) in the divided attention condition relative to non-abused/low dissociation children. This supported the proposal that exposure to family violence and dissociation together may relate to changes in attention strategies, such as the use of divided attention, to keep threatening information out of awareness (Becker-Blease, Freyd & Pears, 2004).

Becker-Blease et al. (2004) made an important first step in examining the relationship of attention and dissociation in children. In extending this line of work, we made some methodological modifications. First, Becker-Blease and colleagues measured dissociation using a subscale of a trauma symptom checklist assessing absorption but not other symptoms of dissociation. Absorption likely reflected a less pathological facet of dissociation (see Brown et al., this volume for discussion). Second, their task combined attention and affective manipulations. This manipulation was helpful for studying the effects of attentional conditions on memory. However, just as the adult literature grapples with the conditions under which attentional correlates of dissociation are observed (e.g., Dorahy et al., 2004), the child literature would benefit from studies that consider the effects of dissociation on attention to and processing of emotion-neutral stimuli. Finally, a more thorough exploration of attentional and childhood dissociation will be aided by a more direct test of attention using reliable, standardized, and normed assessment tools that isolate different attention-related cognitive processes.

This study represents a preliminary and exploratory initiative to delineate the relationship between childhood dissociation and attention skills using a standardized assessment battery. Twenty-four 5- to 8-year-old foster children completed several subtests of the NEPSY: A Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1998) in the Attention/Executive Functioning (AEF) domain. Scores on the NEPSY tasks were correlated with foster caregiver ratings of child dissociation based on the Child Dissociative Checklist (CDC; Bernstein & Putnam, 1986). Foster care children were selected for the study because they have been reported to have elevated average levels of dissociation (Putnam, 1997) and would be expected to represent a wider range of CDC scores than found in a community sample. Children in foster care also have high rates of neglect, abuse, and multiple traumas (Pears & Fisher, 2005).

Given the previous adult literature (DePrince & Freyd, 1999; Freyd et al., 1998), we predicted that higher levels of dissociation would be as-

sociated with poorer performance when tasks required inhibition. As indicated in Table 1, we assumed that the Knock and Tap and Auditory Attention Part A tasks required inhibition (see task descriptions below). This assumption was based on both the Nepsy manual, which indicates that Knock and Tap requires soley inhibition, and the attention literature, which defines inhibition as a necessary component of selective attention (Houghton, Tipper, Weaver, & Shore, 1996) required in the Auditory Attention Part A task. Task analyses for the remaining Nepsy attention spectrum tasks are also described in Table 1; testing the relationship between performance on these tasks and dissociation was exploratory.

METHOD

Participants

Twenty-four foster caregiver-child dyads in Lane County, Oregon were recruited through the local child welfare division. The children were part of a pilot for the Kids in Transition to School (KITS) Project, an intervention designed to increase the school readiness of children in foster care (Pears, Fisher & Bronz, 2006). This project was part of several ongoing foster care studies being conducted at the Oregon Social Learning Center (e.g, Fisher, Gunnar, Chamberlain, & Reid, 2000). Caseworkers were first approached and asked if foster caregivers could be contacted in order to offer participation in the study. If foster caregivers subsequently agreed to participate in the study, consent for the foster children to participate was obtained from the caseworkers (who represent the children's legal guardian the State of Oregon). Consent was received from all participating foster caregivers, and children provided assent. None of the recruited children declined to participate. Foster caregivers were paid $20 for their participation, and foster children received a small toy, juice and snack.

The sample of 24 children included 11 males ranging in age from 5.13 to 7.93 years (M = 6.47, SD = .91) and 13 females ranging in age from 4.99 to 8.48 years (M = 6.62, SD = 1.12). Twenty-one children were Caucasian, two were African American, and one was Native American. Because the study was a small pilot of an intervention focused primarily on promoting school readiness in children, practical constraints limited the ability to gather information on trauma history and clinical diagnoses information.

TABLE 1. Spearman's Rho Correlation Table of CDC Scores to NEPSY Scaled Scores with task analysis for subtests.

Subtest	Tower	Visual Search Faces	Auditory Attention	Auditory Response Set	Knock and Tap
Task Analysis per Nepsy Manual	Planning, Problem Solving, Monitoring	Speed & Accuracy	Inhibition+** & Selective Attention	Complex Cognitive Set & Set Shifting	Inhibition*
Child Dissociative Checklist	.07	.11	−.45*	−.16	−.58**
p	.73	.61	.03	.47	.003
Tower		−.11	−.03	−.26	−.10
p		.63	.88	.24	.65
Visual Attention Faces			−.25	−.35	−.49
p			.24	.10	.02
Auditory Attention				.80**	.36
p				.001	.09
Auditory Response Set					.49*
p					.02

significance* < .05 ** <.01
*Predicted deficit related to higher levels of dissociation.
+Indicates that although the NEPSY creators did not identify this subtest as a measure of inhibition, research indicates that by definition, inhibition is involved as a component of selective attention.

Measures

Child Dissociative Checklist. Dissociation was measured using the Child Dissociative Checklist (CDC), an observer-report measure used for screening children aged 5 to 18 (Bernstein & Putnam, 1986). The CDC measures children's dissociative behavior across a variety of contexts, including school, home, and play. An adult who is familiar with the child typically completes the CDC. The CDC has been shown to be reliable with a variety of different respondents including non-abusing parents, foster parents, and clinicians (Peterson & Putnam, 1994; Putnam, 1997). The CDC asks about a variety of child behaviors in the past 12 months, with responses being provided on a 3-point scale where 0 = "not true," 1 = "somewhat or sometimes true," and 2 = "very true." Summed scores in normal populations fall in the 2 to 3 point range out of a total possible 40 points. Scores in samples of maltreated children typically have a mean of 10.3 for 5- to 8-year-olds (Putnam, 1997). Children with Dissociative Disorder Not Otherwise Specified (DDNOS)

and with Dissociative Identity Disorder (DID) typically have summed scale scores at least as high as 20 (Putnam, 1997). The internal consistency and test-retest reliability of the CDC is well established (Putnam et al., 1993; Wherry, Jolly & Feldman, 1994). Cronbach's alpha can be as high as .95 in large, diverse samples and in smaller samples, Cronbach's alpha is typically .73 with normal controls, .91 with sexually abused girls, and .80 with DID patients (Putnam et al., 1993). Split half reliabilities and test-retest reliabilities over one year are also high (Putnam et al., 1993). Good convergent validity has been established with a narrative dissociation assessment method (Macfie et al., 2001) and with therapist reports (Peterson & Putnam, 1994).

The NEPSY. Executive functions were assessed using the NEPSY, a standardized neuropsychological assessment instrument developed for use with children aged 3- to 12-years-old (Korkman, Kirk & Kemp, 1998). The NEPSY has been normed on a stratified sample of 1000 U.S. children of diverse ethnic backgrounds (50% female); good test-retest reliability, inter-rater reliability, and content validity have been demonstrated (Korkman, Kirk & Kemp, 1998). The NEPSY assesses five functional domains: Attention/Executive Functions, Language, Sensorimotor Functions, Visuospatial Processing, and Memory/Learning. The Attention/Executive Functions (AEF) core domain measures were used for the present study. The internal consistency and stability of the AEF subtests range from .83 to .87 for stratified age groups of 5 to 8 years. For the present study four subtests of the AEF domain were used, and the other NEPSY domains were not assessed. The four AEF tests administered, described in more detail below, included Tower, Visual Attention, Auditory Attention and Response Set, and Knock and Tap. Due to the age range of the sample, we did not administer two subtests (Statue and Design Fluency; Klenberg et al., 2001). The Tower subtest is a challenging task involving a variety of attention skills. It assesses planning, monitoring, self-regulation, and problem solving. This task involves a color picture as visual stimuli, three colored balls (yellow, red, blue) and three pegs fixed to a stationary board. For each trial, the child is to move the three colored balls, one at a time, using only one hand, so that the end result matches the stimulus picture. The child can use only a limited number of moves (as directed by the administrator) to recreate the stimulus picture. As inhibition is not implicated in Tower performance, no prediction was made regarding the association between dissociation and Tower performance.

The Visual Attention subtest is designed to assess attention in children as young as three. It measures the child's speed and accuracy for

visually scanning an array of line drawings in order to locate and mark target drawings using a crayon. The subtest is scored by summing the number of correct targets, subtracting errors (incorrect targets), and factoring in speed (used for determining scaled score). In set A, the child locates a single style of cat amidst several other distracters (e.g., rabbit, flowers). In set B, the child must find two different faces from an assortment of similar other faces. There are 20 correct targets in each of set A and B, among 76 incorrect targets. Although set A and B of the visual attention task are typically collapsed into a single score (Korkman, Kirk & Kemp, 1998), these two variables were considered separately in the correlation analyses following previous work (Klenberg, Korkman & Nuuttila, 2001). Standard scores for the separate components were created using the same procedure as described below for the Auditory Attention measures. Neither the NEPSY manual (Korkman, Kirk & Kemp, 1998) nor the cognitive attention literature (Plude, Enns & Brodeur, 1994) consider visual search a task of inhibition. As inhibition is not implicated in visual search, no predictions were made regarding the correlation between dissociation and either set A or B of the visual attention task.

The Auditory Attention and Response Set tasks are typically collapsed into a single auditory attention and response set measure. More recent work has examined these scales separately (Klenberg, Korkman & Nuuttila, 2001) as they require different skill sets and represent varying levels of difficulty. Part A is relatively straightforward for children to perform. It is a three-minute continuous performance test of selective auditory attention (Korkman & Pesonen, 1994). It is considered to be "relatively simple and repetitive" (Korkman et al., 1998, p. 244). Part B is more challenging in that it requires the child to utilize a more complex cognitive set of skills including learning a new complex rule set, shifting sets, and regulating responses to contrasting stimuli (Klenberg et al., 2001; Korkman et al., 1998).

Both parts A and B require that the child listen and respond to an audiotape presentation of 180 words presented at 1 second intervals, for example "red . . . square . . . put . . . yellow . . . empty . . . thing . . . now." In part A the child is instructed to attend only to the word "red" and to place a red foam one inch square in a box lid upon each presentation. The child is provided with a haphazard pile of 16 blue, 14 yellow, 7 black, and 33 red squares from which to make a selection. The child is instructed, in part A, to ignore all other words and not to do anything at all until the word red is heard again. The child is allowed to practice twice while the test administrator reads a list of 11 words. If the child responds

to the stimulus within one second, 2 points are scored, and within two or three seconds, 1 point is scored. There is a possible total score of 60 points (i.e., 30 targets) however commission errors, such as placing a blue tile in the box, result in the loss of 1 point. Scoring is done discretely so that the child does not get feedback. The tape plays continuously for 3 minutes without pause. Part A has a maximum score of 60. Because this is a measure of selective attention, of which inhibition is a necessary component (Houghton et al., 1996), we predicted a negative correlation to dissociation.

Part B immediately follows part A and the child is instructed to follow a new set of instructions. He or she must now put a yellow square in the box lid when s/he hears the word "red," do the opposite when hearing the word "yellow" by placing a red square in the box lid and follow a new rule when hearing the word "blue" by putting a blue square in the lid. Instructions further state that the child should do nothing upon hearing anything else at all. The child is permitted to practice twice to a list of 12 words that the administrator reads, before the auditory tape is played. Part B also consists of 180 words read at 1 second intervals. It contains 36 target words, 11 yellow, 11 red and 14 blue. Scoring is the same method as Part A. Part B has a maximum score of 72 points. We did not have a specific prediction for the relationship between dissociation and this task of complex cognitive sets.

In order to obtain separate scaled scores for both Parts A and B, we multiplied the raw score of Part A by 2.2 and Part B by 1.83 so that each of these subscales represented a score out of the maximum total 132 points. This approach is consistent with practices in the field to transform NEPSY scoring procedures to analyze separate parts of a subtest (see Perner, Kain & Barchfeld, 2002). From this value, a standard score was obtained from the NEPSY scoring manual. Analyses conducted on the untransformed raw scores had comparable results, but scaled scores were used to account for the expected performance differences due to age (Korkman et al., 1998; Klenberg et al., 2001).

Finally, the Knock and Tap subtest assesses the child's ability to inhibit behavioral impulses in response to visual stimuli that conflict with verbal directions (Korkman et al., 1998). In the first, most simple set, when the administrator knocks, the child must tap and vice versa. The child has several seconds to respond in each trial (where one knock or one tap equals a trial). In the second set, when the administrator makes a fist and taps with the side of her hand, the child must do a knock with her knuckles, and vice versa. When the administrator lays her hand flat on the table the child is told to do nothing at all and to keep the current hand

position. As inhibition is implicated in this task, a negative relationship between dissociation and Knock and Tap performance was predicted.

Procedure

Foster caregivers completed the CDC in the Oregon Social Learning Center waiting room while child participants accompanied a test administrator to "play some games" and "win prizes." The NEPSY subtests were administered by trained clinical psychology doctoral students.

RESULTS

Dissociation

CDC scores in the sample ranged from 0 to 20, with a mean of 8.92 (SD = 5.74), Cronbach's alpha = .78. Compared to hundreds of normal controls (Putnam, 1997) the mean of this group is substantially higher (Cohen's *d* effect size = 1.9) but is comparable to samples of maltreated children (Putnam, 1997; Cohen's *d* effect size = 0.17). This suggests that although the sample of foster children is small, the range of dissociation scores expected among maltreated or neglected children are represented. CDC scores were distributed continuously across the 0 to 20 range, with no obvious grouping or divide between high and low dissociators. Past work examining the relationship of dissociation to attention has used larger samples and thus has been able to utilize only the high and low scores removing scores that were roughly within a standard deviation of the mean. Given the small sample size and the absence of an obvious break in scores, dissociation was treated as a continuous variable and correlation analyses were used.

Attention/Executive Functions

Scaled scores on the Tower task were normally distributed (M = 8.21, SD = 3.01). Most children scored at ceiling on the Cats visual attention subtest, so we did not include these in further analyses. Scaled scores on the second subtest of visual attention task (faces) had a moderate positive skew as did the Knock and Tap. Scaled scores on the auditory attention and response set subtest were normally distributed. We examined the two subtests separately as suggested in Klenberg et al. (2001). The

scaled score for selective auditory attention was (M = 9.13, SD = 3.71) and for the more complex part B auditory response set (M = 7.5, SD = 2.38).

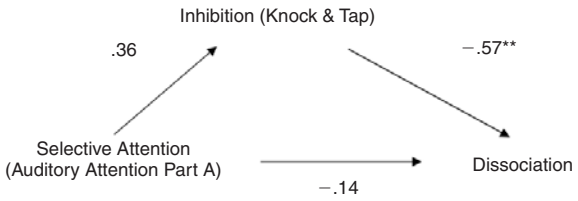
Correlations Between AEF and Dissociation

Table 1 presents correlations between the attention measures and CDC scores. Age was not controlled for in analyses as the scaled scores have factored age into the transformations from raw scores. Spearman's rho was used when calculating correlations for two reasons. First, there were up to two outliers on individual subscore measures and Person's r is sensitive to outliers. Second, the NEPSY uses scaled scores which transform the data into rank order data. Spearman's rho calculates correlations using rank ordered data and is therefore the appropriate test to use.

Of the three NEPSY subtests that were not classified as involving inhibition, there was no association between CDC scores and performance. The Tower, Visual Attention task, and Auditory Response Set all showed near-0 Spearman's rho correlations (see Table 1). It was predicted that dissociation would be negatively related to performance on the Knock and Tap, which requires inhibition. This hypothesis was supported, Spearman's rho = $-.58$, $p = .003$. This is considered a 'large' effect size. Inspection of the scatter plot revealed one far outlier. When this outlier was removed, the correlation remained significant, rho = $-.60$, $p = .003$. Because of the small sample size, we did not remove this outlier and report the more conservative score in the correlation table.

There was also a significant negative correlation between dissociation and Part A of the Auditory Attention Task, Spearman's rho = $-.45$, $p = .03$, which is a large effect size. As an internal validity check, we noted that performance on the two Auditory Attention Tasks was highly correlated, spearman's rho = .77, $p = .0001$. Because inhibition is thought to be a necessary component of selective attention (Houghton et al., 1996), we explored this selective attention relationship to dissociation using path analysis which allowed us to see if inhibition accounted for the effects of selective attention (Baron & Kenny, 1986). Using CDC score as the predicted variable in a regression model with Knock and Tap (inhibition) and auditory attention Part A (selective attention), we find that there is strong support for inhibition mediating the effect of the selective auditory attention. See Figure 1 for a model schematic.

FIGURE 1. Mediation Model of Inhibition, Selective Attention and Dissociation



The model shows that when Inhibtion/Knock and Tap is entered into a model mediating Selective Attention, the relationship between this task and dissociation is no longer significant.
**$p < .001$

DISCUSSION

This study examined the relationship between attention and dissociation in foster children. We had predicted a negative relationship between dissociation and performance on tasks requiring inhibition, as observed in the adult literature (DePrince & Freyd, 1999, 2001; Dorahy et al., 2002; Freyd et al., 1998). We also endeavored to expand this literature with exploratory analyses of other domains within attention, including visual search and planning. By using a standardized and normed neuropsychological assessment battery, we evaluated performance on five attention tasks tapping several facets of attention. We found no evidence for a relationship between dissociation and performance on tasks that required planning, problem solving and complex cognitive sets.

As predicted, higher levels of dissociation were associated with worse performance on Knock and Tap, a classic measure of inhibition. This finding is consistent with previous attention studies that demonstrated inhibition deficits in maltreated children with BPD characteristics (Rogosch & Cicchetti, 2005), adult DID patients (Dorahy et al., 2002), and high-dissociating college students (Freyd et al., 1998). That we replicated findings of inhibition deficits with a sample of young children doing developmentally appropriate tasks suggests that the inhibition/dissociation relationship may have its origins early in development.

A strong negative relationship was also observed between dissociation and Auditory Attention performance. The NEPSY manual identifies this task as a selective Auditory Attention Task. However, during test admin-

istration, we noted that this auditory attention measure behaviorally could be likened to a go/no-go task, which is a common measure of inhibition. In a go/no-go task, the same response (placing a red square in the container) is given for the 'go' stimulus (the word 'red') and inhibited for all other stimuli (the words 'yellow,' 'blue,' 'put,' etc.). The child must respond only to the word 'red,' and inhibit responses to all other stimuli. As indicated in the attention literature, inhibition is a necessary component of selective attention. Therefore this strong relationship between the Auditory Attention and dissociation was not surprising. In utilizing the Baron and Kenny (1986) path analysis technique, we were able to essentially partial out the effect of inhibition and found that selective attention no longer significantly predicted dissociation. This modeling lends further support for the relationship between inhibition and dissociation. We acknowledge however, that inhibition is an ill-defined word in the cognitive literature (see MacLeod, Dodd, Sheard, Wilson, & Bibi, 2003 for review). In the present analyses we are taking the position of MacLeod et al. (2003) that "inhibition" which some have posited is synonymous with selective attention (e.g., Houghton et al., 1996) actually has several meanings and likely is a component of, yet not the same as, selective attention.

Despite the negative relationship between dissociation and auditory attention, we did not find a similar relationship with the Auditory Response Set task, a test requiring complex rule sets and set shifting. Success at this task may be explained by the use of organizational strategies (see MacLeod et al., 2003) rather than inhibitory abilities. Dissociation was also not related to children's performance on visual search and tower tasks. This suggests that dissociation is not associated with a pervasive impairment in cognitive performance in the general attention/executive functioning domain as measured by the NEPSY. Further study will be needed, however, in order to more broadly assess cognitive differences related to dissociation.

These findings support DePrince and Freyd's (1999) speculation that individuals may develop alternative cognitive styles in order to accommodate dissociative tendencies. Our data point to strong relationships between dissociation and inhibition in the absence of other deficits (e.g., planning) in children as young as 5-8 years. Over time, dissociative children may compensate for inhibition deficits as other cognitive functions develop (e.g., complex cognitive sets, set shifting), creating a set of skills that appear to be relative strengths. Though we cannot test this longitudinal hypothesis in the current data set, this proposition is supported by the literature on neuroplasticity. Such research

documents that, in the face of deficits in some areas, compensatory strengths can develop in other domains (e.g., Bavelier, Tomann, Hutton, Mitchell, Corina, Liu, et al., 2000; Neville & Bavelier, 2002; Stevens & Neville, 2006). Therefore, skill development in other aspects of attention may help dissociative children compensate for relative difficulties in inhibition over time.

This fits with DePrince and Freyd's (1999) observation that high dissociators show decreased interference under divided attention conditions relative to selective, compared to low dissociators. Further, recent intervention studies have demonstrated the malleability of attention following specific training activities (Green & Bavalier, 2003; Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005). Thus, the possibility that early effects of dissociation may lead to adaptations in cognitive style over time is an exciting area for future study.

Clinical Relevance

From a clinical intervention perspective, treatment models for dissociative pathology center on an executive function (EF) framework (e.g., Hornstein, 1998; Putnam, 1997; Silberg, 1998). In treating severely pathologically dissociative children (with DID), clinicians train the child and the child's family to give the child executive control over his or her alter personalities. For example, the clinicians may refuse to talk to any of the alter personalities and require the child to act as a go-between for the alter personalities and the clinician. Thus, this therapy teaches the child to master several EFs. Specifically, the child must learn to control cognitive shifting between alters so that he or she can be present with the clinician; the child learns to inhibit the voices of alter personalities; and the child learns emotional self-control and organizational skills as the executive cognitive functions are trained and developed. Therefore, from a clinical level of observation, we see an apparent relationship between EF and dissociation, through which EF is increased while dissociation decreases.

Differential Diagnosis

A clear understanding of the cognitive correlates of child dissociation may aid in improving differential diagnosis of dissociative disorders in clinical populations. Dissociative disorders often go undiagnosed or co-present with other conditions such as anxiety, mood, and conduct disorders (Hornstein, 1998; Peterson, 1998; Ross, 1996; Silberg, 1998)

as well as ADHD (Peterson, 1998; Silberg, 1998). In comparing the present study to studies evaluating attention performance of children diagnosed with ADHD we find critical differences. In a meta-analytic review of 83 ADHD studies, Willcutt and colleagues (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005) found that ADHD children did poorly on inhibition (comparable to NEPSY Knock and Tap), set shifting (comparable to NEPSY auditory part B), and planning (Tower tasks). These data point to common deficits in inhibition between high dissociation and ADHD samples however the patterns diverge for planning/complex tasks. The current findings point to the possibility that dissociation and ADHD could be differentiated by performance on planning/complex tasks. Thus, this study points to the value of additional, larger scale studies designed to identify difference in cognitive performance between highly dissociative children and children diagnosed with ADHD.

Limitations of the Present Study

There were several limitations to the present study. First, the small sample size limits both power for and choice of statistical analyses. Previous research relied on group comparisons of high versus low dissociators; however, we were unable to do such comparisons, as we had a consistent range of CDC cores from 0 to 20 without an obvious cut point. Between group comparisons would have required that we remove participants whose CDC scores were about one standard deviation on either side of the mean, and this would have reduced our sample size and thus our statistical power. Second, child maltreatment data were not collected for this sample. We assumed that many if not all of the children entered foster care because of some form of maltreatment or neglect. However, we were unable to examine the relationship between chronicity or severity of maltreatment and neuropsychological performance.

Future Directions

This study provides exciting directions for future research. First, this study provides clear justification for future empirical work examining the association between neuropsychological function and dissociation with larger samples of foster children. Second, future studies should collect information about maltreatment exposure, clinical diagnoses, length of time in foster care, and other responses to trauma (beyond dis-

sociation). Ultimately, as we look to the future, we hope that specific attention "leverage points" can be identified as particular deficits and strengths for highly dissociative children. By delineating cognitive environments that either enhance or improve performance as a function of dissociation, educational interventions can be designed to support dissociative children's academic success.

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