

Investigating Suggestibility
in Children with Fetal Alcohol Spectrum Disorder

by

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B. A. H., McMaster University, 2007

A Thesis Submitted in Partial Fulfillment
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in the Department of Psychology

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Supervisory Committee

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Abstract

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Interrogative suggestibility refers to the extent to which an individual internally accepts messages communicated during a formal questioning situation, as indicated by an external response. Research indicates low intelligence, poor memory and weak inhibitory control is associated with heightened suggestibility. Children with fetal alcohol spectrum disorder (FASD) may also display deficits in these key areas, indicating a potential vulnerability to suggestion. The present study compared levels of suggestibility among alcohol exposed and typical children. The findings indicate that children with FASD may be at heightened risk to suggestion following negative feedback or pressure. In addition, a large amount of the suggested material was elicited and internalized as truth by all children, dependent on question format. These findings have important consequences for future interrogative interactions with children with and without FASD, to ensure information is not presented and thus elicited in a suggestive manner.

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Introduction

The History of Suggestibility

The concepts of suggestion and suggestibility are believed to have originated from hypnotists in the 19th century (Coffin, 1941). Although related, suggestion and suggestibility are distinct and viewed as independent constructs. In general, a *suggestion* is viewed as a stimulus presented in the form of a hint, cue or idea that carries the potential to elicit a reaction from the individual who is being incited to respond (Gudjonsson, 2003). This notion is separate from that of *suggestibility*, which is conceptualized as the susceptibility of an individual to respond in a particular way to suggestions. This susceptibility depends on the personality characteristics, cognitive attributes, and coping strategies of the person, as well as the individual's interpretation of the suggestion (Gudjonsson, 2003).

Eysenck's (1943) early and influential research utilized empirical evidence to develop a classification model of suggestibility that delineated distinct subtypes of suggestibility. *Primary* suggestibility involves responses to suggestions upon the motor system and is consistently correlated with hypnotizability. For example, in the Body Sway test, the individual is blindfolded and told that he or she will fall forward or backward; the amount of actual movement produced in response to this suggestion is then measured. *Secondary* suggestibility refers to responses to direct or implied suggestions that the individual will experience a sensation or perception, without any existential basis for the sensation or perception. For example, in the Progressive Lines test, two equal lines are presented, and the suggestion is made that the lines differ in length.

Suggestibility is measured by the extent to which the individual accepts the suggestion. Finally, *tertiary* suggestibility involves a change in attitude by the individual in response to persuasive communication from a reputable figure (Eysenck & Furneaux, 1945).

In 1986, Gudjonsson and Clark proposed a fourth category of suggestibility, termed *interrogative suggestibility*, defined as ‘the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, as the result of which their subsequent behavioral response is affected’ (p. 84). Gudjonsson (1987a) argues there are three primary differences between interrogative suggestibility and other types of suggestibility. First, suggestibility of the interrogative type involves a formal and typically stressful questioning procedure within a social interaction in which the interviewee and interviewer are typically alone in a room. For example, children who testify in court rarely undergo pretrial forensic interviews in the presence of socially supportive individuals, such as a family member (Davis & Bottoms, 2002). Second, questions concern a past event, differing from other suggestibility types that occur within the present situation. Third, there is a more pronounced *uncertainty* factor, as the answers to questions concerning the past event are not conclusively known.

Gudjonsson and Clark (1986) advanced a theoretical model comprised of five interrelated components that form the suggestive interrogative process: 1) the dynamics of the social interaction, which involve a person of authority who controls and directs the interaction; 2) the interview procedure through which questions are posed; 3) a suggestion, expressed explicitly through verbal statements or questions, or implicitly through non-verbal cues; 4) internal acceptance of the suggestion; and, 5) an observable behavioral response demonstrating the acceptance of the suggestion.

Bruck and Ceci (1997) assert the strongest causal factor leading to interrogative suggestibility is *interviewer bias*, which ‘characterizes an interviewer who holds a priori beliefs about the occurrence of certain events, and, as a result, molds the interview to elicit from the interviewee statements that are consistent with these prior beliefs’ (p. 75). This statement broadly encompasses the first three components of the model, in which during the social interrogative situation the interviewer suggests a piece of information based on knowledge or beliefs the interviewer holds about the event in question. The final two features of suggestive interviews are shared with other types of suggestibility, and refer to internal acceptance and an external behavioral response indicating the individual has acquiesced to a suggestion (Gudjonsson, 1984).

According to Gudjonsson and Clark (1986), the suggestibility process depends on an essential triad of conditions experienced by the interviewee, including *uncertainty* regarding the right answer to the question, possibly due to an incomplete or non-existent memory of the event, *interpersonal trust*, referring to the belief that the interrogator has honest, genuine intentions, and an *expectation* perceived by the interviewee to provide a definite answer. Finally, the model stresses that susceptibility to interrogative suggestibility is explained in terms of individual differences that cause certain individuals to be more or less suggestible. Individual differences include unique personality characteristics, cognitive attributes, and coping resources and strategies. The sum of these differences results in the adoption of a suggestible (acceptance of suggestion) or resistant (rejection of suggestion) response repertoire (Gudjonsson, 2003).

The model of interrogative suggestibility as advanced by Gudjonsson and Clark (1986) has strongly influenced research on suggestibility and the development of

suggestibility measures. Gudjonsson (1984) constructed the first objective psychometric instrument for measuring interrogative suggestibility, the Gudjonsson Suggestibility Scale (GSS), and shortly after a parallel version, GSS2 was devised (Gudjonsson, 1987b). The narrative content of the GSS2 is simpler than the GSS1, and researchers typically prefer this version for research with children and individuals with cognitive impairments (Gudjonsson, 2003).

These scales assess an individual's suggestibility in response to leading questions, referred to as *Yield*, and an individual's suggestibility in response to negative feedback, referred to as *Shift*. Specifically, after hearing a short story, the child answers a series of non-leading and leading questions (Yield) and then is told that a number of errors have been made and the same series of questions are re-asked (Shift). All measures of suggestibility incorporate Gudjonsson and Clark's (1986) core postulation that suggestibility level can be determined through a behavioral reaction in response to misleading questions or negative feedback and include measures of Yield and/or Shift.

Factors Related to Children's Suggestibility

Age and Intelligence

Consistent with the view that suggestibility can be explained by individual differences, studies have examined factors that affect children's susceptibility to suggestion. Note that in all studies, higher scores on suggestibility scales denote elevated suggestibility. The most reliable predictor of suggestibility is age: younger children are less able to resist suggestion than older children and young adults, as demonstrated by research investigating suggestibility in individuals aged 3 to 26 (Danielsdottir,

Sigurgeirsdottir, Einardsdottir, & Haraldsson, 1993; Melinder, Endestad, & Magnussen, 2006; Redlich & Goodman, 2003).

With the exception of age, the pattern of results for predicting children's suggestibility from cognitive and personality factors have been relatively inconsistent. Indeed, differences across studies in terms of participants, measures of suggestibility, cognition and personality, methodology, and interpretation contribute to conflicting results across studies. Further, many studies posit 'causal' relationships between cognitive or personality factors and suggestibility on the basis of significant correlations. However, correlation implies only the strength and direction of the relationship between variables, and cannot determine the cause of the relationship. Although it is possible that a cognitive or personality factor causes an individual to adopt a suggestible response style, this is merely one interpretation of a significant correlation. However, other interpretations cannot be eliminated, such as possibility that the correlation was caused by a third variable, was spurious, or even that a suggestible response style causes a cognitive or personality factor.

With the aforementioned caveats in mind, intelligence is one individual difference factor hypothesized to protect from susceptibility to suggestion. McFarlane, Powell, and Dudgeon (2002) found that in 3 to 5-year-old children, higher intelligence quotient (IQ) scores, as estimated by the Information subtest of the Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI-R), were associated with lower Yield scores. Similarly, Geddie, Fradin, and Beer (2000) found that higher IQ scores in children ages 3 to 6, as measured with the WPPSI-R short form (comprised of Comprehension, Arithmetic, Picture Completion and Block Design subtests), also correlated with lower

Yield scores. However, higher intelligence is not consistently related to lower Yield scores. For example, in a study with children ages 5 to 13, IQ was estimated using the Vocabulary and Block Design subtests of the Wechsler Abbreviated Scale of Intelligence (WASI), and was not found to correlate with a Yield measure, although intelligence did correlate negatively with a measure of Shift (Young, Powell, & Dudgeon, 2003).

Alternatively, several studies fail entirely to support the claim that intelligence is related to suggestibility. For example, Henry and Gudjonsson (1999) measured IQ using the Wechsler Intelligence Scale for Children, 3rd Edition (WISC-III) in 7 to 12-year-old children and did not find a correlation between intelligence and Yield or Shift scores. Likewise, 3 to 17-year-old children did not demonstrate any significant relationship between intelligence, estimated from Raven's Progressive Matrices Test, and a Yield measure (Eisen, Qin, Goodman, & Davis, 2002).

Although there appears to be inconsistent evidence supporting an association between intelligence and suggestibility in typically developing children with at least average IQ, when studies include children with intellectual disabilities, there appears to be a more conclusive association between intelligence and suggestibility. Studies which have compared children with intellectual disability to typically developing children find that IQ is reliably related to suggestibility, with lower IQ correlating with higher suggestibility. For example, using four subtests from the WISC-III (Picture Completion, Similarities, Block Design and Vocabulary), 11 and 12-year-old children with mild to moderate intellectual disability (*Mean IQ* = 60) were significantly more suggestible than age matched controls on a Yield measure (Henry & Gudjonsson, 1999). Michel, Gordon, Ornstein, and Simpson (2000) investigated the influence of intelligence on suggestibility,

employing the Peabody Picture Vocabulary Test-Revised (PPVT-R) as an estimate of IQ. These authors report that children aged 4-13 with intellectual disability (*Mean IQ = 58*) scored significantly higher on a measure of Yield than did age matched typically developing controls (*Mean IQ=109*). Henry and Gudjonsson (2003, 2004) measured intelligence in children ages 10 to 13 using the British Abilities Scale-II (BAS-II) and found that lower intelligence correlated with higher suggestibility scores, as reflected by both Yield and Shift measures. In accordance with these observations, Bruck and Melnyk (2004) reviewed the results of 22 studies that examined the relationship between intelligence and suggestibility in samples including typically developing children and children with intellectual disability. They concluded that IQ is an important predictor of suggestibility only in samples with children with lower IQ. Similarly, Young et al. (2003) compared the relative impact of IQ on suggestibility in samples of children with and without intellectual disability, and found that IQ accounted for a significantly greater proportion of the variance in performance on the suggestibility measure in the intellectually disabled group of children. Overall, research suggests sub-average IQ confers a vulnerability to suggestion, indicating children with intellectual disability may be especially susceptible to suggestion.

Memory

Memory abilities are also postulated to influence suggestibility, such that if recall of the event is poor, then the child may be more willing to accept a suggestion because the answer is unknown. This reasoning fits well with Gudjonsson and Clark's model of interrogative suggestibility (1986) where it is theorized that higher uncertainty leads to elevated suggestibility. If memory of the event is poor, the individual likely experiences

higher levels of uncertainty in response to questions about the event, and hence might be more willing to accept suggestions. Related to the discussion of memory and suggestibility, Pezdek and Roe (1995) proposed the memory trace strength theory, according to which stronger memories are more resistant to suggestion than weaker memories. Two possible explanations are advanced as to why stronger memories might act as a barrier to suggestibility. First, weaker memories permit more intrusion from external sources, and second, suggested information is more likely to be retrieved if the original information is retained only in a weak form, as suggested and original information for an event coexist in memory. In summary, poor memory of the event is hypothesized to lead to heightened uncertainty and permits extraneous and suggested information to be erroneously recalled.

Calicchia and Santostefano (2004) used a measure of visual memory from the Cognitive Control Battery to investigate suggestibility as measured by the GSS2. Results indicate that visual memory was negatively correlated to measures of Yield and Shift. Lee (2004) examined working and delayed memory in relation to suggestibility in 7-9 and 15-17-year-old children. The backward digit span test (BDS) from the Children's Memory Scale (CMS) was used as a measure of working memory; the delayed memory scores on the California Verbal Learning Test (CVLT) and the verbal paired associates test (VPA) from the CMS were used as measures of long-term memory. The results indicate that working memory, believed to reflect activation in frontal brain regions, was related to Shift, whereas long-term memory, thought to reflect activation in medial temporal structures, was related to both Shift and Yield. The negative correlation between memory and interrogative suggestibility may imply that better mnemonic

functioning reduces suggestibility. Further, these results may indicate that there is specificity with regard to the brain regions involved in Yield and Shift measures of interrogative suggestibility.

In contradiction to these findings, Clarke-Stewart, Malloy and Allhusen (2004) failed to find a relationship between suggestibility and the Memory for Sentences subtest from the Woodcock-Johnson-Revised in 5-year-old children. Likewise, Henry and Gudjonsson (2003) did not report any significant association between the verbal and nonverbal memory scales of the Test of Memory and Learning (TOMAL) and suggestibility in 11 to 12-year-old typically developing children, although they did report a significant negative correlation between the verbal memory score and suggestibility in 11 to 12-year-old children with intellectual disability.

Studies have also used measures of declarative memory (memory for facts or events) to investigate suggestibility. One type of declarative memory is episodic memory, which is defined as memory of an event and includes memory of contextual information such as the time, place, and emotions associated with the event (Tulving, 2002). McFarlane et al. (2002) used the Video Suggestibility Scale for Children (VSSC) with children ages 3-5, which involves presenting a 5-minute video of a birthday event and then asking a series of misleading and non-leading questions. These authors found that better delayed recall for the details of the birthday event was associated with lower suggestibility as reflected by a Yield measure. Indeed, many researchers have found that the provision of a greater amount of accurate information pertaining to the suggestibility event is associated with resistance to suggestive questions (Alexander, Goodman, Schaaf, Edelstein, Quas, & Shaver, 2002; Scullin, Kanaya, & Ceci, 2002; Templeton & Wilcox,

2000). Moreover, multiple presentations of the event decreased susceptibility to suggestion, in that children were less suggestible after listening to a story twice (Endres, Poggenpohl, & Erben, 1999) or viewing a slide sequence twice (Pezdek & Roe, 1995). These results may imply that better memory of the event reduces vulnerability to suggestion.

In summary, research tentatively supports a relationship between memory and suggestibility, and the association appears most robust when considering declarative memory. Also, the results of Henry and Gudjonsson (2003) demonstrate a relationship between memory and suggestibility exclusively in the intellectually disabled sample of children. Due to the significant overlap in the neurological mechanisms related to intelligence and memory (Conway, Kane, & Engle, 2003), this finding may indicate that the relationship between memory and suggestibility is more pronounced in children with memory and/or intellectual deficits. Similar to the heightened risk of suggestion conferred by low IQ, this could suggest that certain populations of children with documented memory impairment could be at heightened risk of suggestion.

Executive Functioning

Research has also explored the influence of executive functioning in the context of suggestibility. Executive functioning (EF) refers to higher-order cognitive processes involved in planning, guiding, and monitoring behavior in order to efficiently achieve a goal (Kodituwakku, Kalberg, & May, 2001a). One of the most commonly postulated aspects of executive function is cognitive inhibition, or the suppression of a prepotent or automatic response. Inhibitory abilities have been closely linked to suggestibility, largely because the timing of improvement in cognitive control immediately precedes a dramatic

decrease in suggestibility. Harnishfeger and Bjorklund (1994) suggest cognitive inhibition improves over childhood, such that children become more efficient at attending to target stimuli and ignoring task-irrelevant stimuli. These improvements typically occur between the ages 4 and 7, and are thought to be dependent on frontal lobe development (Dempster, 1993). Similarly, research shows that preschoolers demonstrate especially high rates of suggestibility compared to older children, suggesting the substantial decrease in suggestibility results from the maturation of inhibitory control and the frontal lobes (Bruck & Ceci, 1999).

Prior to this developmental stage, or in children with weak or deficient inhibitory skills, irrelevant stimuli are encoded rather than relevant stimuli, consequently weakening memory for events (Harnishfeger & Bjorklund, 1994). As a result of encoding less relevant information, children with inhibitory deficiencies may be less able to provide complete and accurate reports, and may also be less able to refrain from providing the prepotent response suggested by the interviewer, resulting in higher suggestibility (Alexander et al., 2002). Applying this to Gudjonsson and Clarke's model of suggestibility (1984), if poor inhibitory control leads to a weaker encoding of the event, this may increase uncertainty in response to questions about the event, and, as outlined in the model, uncertainty is hypothesized to result in heightened vulnerability to suggestion.

Further, Scullin and Bonner (2006) hypothesize that children with weaker executive function skills, particularly inhibition skills, may respond impulsively and without reflection to questions. Thus, children with low inhibitory control may be more likely to acquiesce to the interviewer's suggestions. Ruffman, Rustin, Garnham, and Parkin (2001) theorize that susceptibility to suggestion results from a failure to inhibit

recognition based on familiarity. The employment of an ineffective retrieval process such as a strategy based on familiarity could cause an individual to inadvertently recall a previously posed suggestion.

The consequential role of inhibitory control in reducing vulnerability to suggestion in children is tentatively supported by current research. For example, Melinder et al. (2006) measured inhibitory control using the Day-Night “Stroop-like” task, on which children are instructed to say ‘night’ in response to a picture of the sun and ‘day’ in response to a picture of the moon. Findings indicate that stronger inhibition capacities correlated with resistance to suggestions in 3 to 6-year-old children. Similarly, Alexander et al. (2002) also used the Day- Night task to investigate inhibition in 3 to 7-year-old children. The authors found that inhibition was inversely related to a measure of Yield, which may suggest that children with stronger inhibitory skills exhibit lower levels of suggestibility. These authors propose two mechanisms by which inhibitory control may affect suggestibility: a) children with better inhibitory skills may be more able to inhibit distractions during encoding which may permit greater accuracy of the event representation, and may allow for more attention and deeper processing during the encoding phase; and, b) children with better inhibitory abilities may be better able to suppress extraneous or *suggested* thoughts at the time of recall.

Clarke-Stewart et al. (2004) employed a longitudinal design to investigate the influence of inhibition on suggestibility. They created an *adaptive-inhibitory* variable that was comprised of scores from three measures at three different time points. The first was a measure of *inhibitory behavior*, assessed when children were 2-years-old using the Bayley Scales of Infant Development. This involved the examiner presenting an item

and then asking the child to return the item, with the score representing the number of times the child complied with the examiner's request. The second was a measure of *overall adaptive functioning*, which was a rating assigned on a 7-point-scale by the researchers during three assessment visits that took place when children were 2 to 3-years-old. The ratings were based on the researchers observations during tests, semi-structured interactions and unstructured observations, and were averaged over visits and raters. The third was a measure of *inhibitory control*, which consisted of 10 items on inhibitory abilities from the Children's Behavior Questionnaire (CBQ), a parent questionnaire completed when the child was 4.5-years of age. Results indicate a significant association between the adaptive-inhibitory variable and suggestibility. On the basis of their results, the authors infer that children with a lack of self-control in real-life situations, as demonstrated by a child's inability to control his or her own behavior, may be more likely to acquiesce to suggestions in an interview situation.

While these studies support an association between inhibitory control and suggestibility, other studies have failed to demonstrate a clear relationship. First, Roberts and Powell (2005) administered two conflict tasks of inhibition and two verbal inhibition tasks to investigate suggestibility in 5 to 7-year-old children. The two conflict tasks were the Day and Night task and a tapping task in which the child had to tap a pencil once in response to two taps by the examiner, or twice in response to one tap by the examiner. The verbal inhibition measures involved the child repeating a set of three words (e.g., cat-table-clock) followed by another set of three different words (e.g., hat-snake-ladder). The verbal retroactive interference task involved asking the child to repeat the first set of words to determine whether words from the second set interfered with the recall of the

first set, while the verbal proactive interference task involved asking the child to repeat the second set of words to see whether the first set interfered with the recall of the second set. Analyses indicate that performance on the verbal retroactive inhibitory control task was the only measure significantly associated with higher rejection of suggestive information. These results conflict with earlier results, although the authors do suggest that ceiling effects on the verbal inhibition and conflict tasks potentially may have precluded observation of significant correlations.

Second, Karpinski and Scullin (2009) assessed multiple aspects of executive function in 3 to 5-year-old children using three planning tasks (Tower of London, Tower of Hanoi, Truck Loading), two working memory tasks (Digit Span, Noisy Book Task) and three inhibitory control tasks (Day-Night task, Hand Game, Dimension Change Card Sort Task) in relation to the VSSC. Results indicate overall executive function was negatively correlated with the Yield scale of the magic show. Moreover, when the relationship of each individual test to suggestibility was examined, only the Day-Night task and the Digit Span task were significantly correlated to suggestibility, indicating that verbal inhibition ability may be particularly important for resistance to suggestibility. From their review of the literature on suggestibility and executive function, these authors surmise that as children improve on the simpler aspects of executive function, such as inhibitory control, executive abilities may no longer relate to suggestibility, providing a possible explanation for the null findings in studies examining inhibitory studies and suggestibility in older children. Further, implicit to this hypothesis is that children whose basic executive skills fail to develop properly will remain at increased risk of suggestibility.

Although there are no clear findings from the research to date, there is evidence in support of the relationship between executive function and interrogative suggestibility. Inhibitory abilities in particular appear to be uniquely related to suggestibility. One interpretation of these findings is that children with poor inhibitory skills potentially encode irrelevant stimuli, respond impulsively without reflection, are less able to refrain from providing the prepotent (suggested) response, and fail to inhibit recognition based on familiarity. The potential outcome of any of these hypothesized paths is higher suggestibility.

Fetal Alcohol Spectrum Disorders (FASD)

Given the correlation between specific cognitive abilities and suggestibility in typically developing children, the presence of a neurodevelopmental disorder may place certain children at higher risk of interrogative suggestion. In particular, the effects of prenatal alcohol exposure encompass a wide range of physical, cognitive, and behavioral deficits; the unique set of impairments exhibited by children with prenatal alcohol exposure may confer a heightened risk to interrogative suggestion.

In 1973, Jones and Smith were the first to identify the pattern of symptoms caused by significant prenatal alcohol exposure for which they coined the term ‘fetal alcohol syndrome’ (FAS). The criteria for FAS included delayed growth, central nervous system (CNS) dysfunction, and facial dysmorphism. However, not all children exposed prenatally to significant amounts of alcohol are born with FAS (Niccols, 2007). The most important risk factors are related to the nature of the alcohol exposure, such as the timing of exposure during fetal development and pattern of consumption (Chudley, Conry, Cook, Look, Rosales, & LeBlanc, 2005). These factors are most influential

because adverse effects are only seen when exposure exceeds a certain minimum threshold (Jacobson & Jacobson, 1994). Hence, the umbrella term ‘fetal alcohol spectrum disorder’ (FASD) was proposed to promote recognition that the combination and severity of physical, mental, behavioral, and learning disabilities caused by prenatal alcohol exposure comprise a spectrum (Chudley et al., 2005).

Estimates for the prevalence of FAS range from 2.8/1,000 to 4.6/1,000 live births in the United States (Sampson et al., 1997). However, the most frequent characteristic of prenatal alcohol exposure is cognitive impairment rather than facial malformation as required for an FAS diagnosis (Abel, 1980), primarily because the critical period of induction for facial anomalies is very short in duration and occurs early in the gestational period (Astley, Magnuson, Omnell, & Clarren, 1999). In contrast, behavioral and cognitive impairments due to alcohol exposure can occur throughout most of the pregnancy (Rasmussen, Andrew, Zwaigenbaum, & Tough, 2008). Thus, the prevalence of FASD is much higher than FAS. Recent estimates by Health Canada suggest that nine babies per 1,000 born have FASD, or nearly one per 100 live births (Health Canada, 2006). Researchers hypothesize that prevalence rates in the United States and European countries are even higher, with estimates of FASD in populations of school-aged children approximately 2-5% (May et al., 2009).

The effects of prenatal alcohol exposure fall on a continuum, with perinatal death at one end and relative normalcy at the other end (Mattson & Riley, 1998). Individuals in between these endpoints vary in severity of physical, behavioral, cognitive, and learning deficits. From early research with animal studies, it was discovered that alcohol exposure *in utero* caused a developmental delay in the maturation of mechanisms in the brain, and

affected behavioral and cognitive areas of activity levels, response inhibition, learning, and memory (for a review see Abel, 1980; Abel, 1981). Research has now linked prenatal alcohol exposure to impairments in humans, including documented deficits in intelligence, memory, and executive function (Streissguth, 2007). These three domains of impairment are of particular importance to discussions of suggestibility as these cognitive areas are intimately related to levels of suggestibility in children. In addition, children with prenatal alcohol exposure are commonly described as vulnerable to suggestion in anecdotal and clinical reports (Fast & Conry, 2004). For example, in a study investigating secondary disabilities in individuals with FASD aged 17 and older, Clark, Lutke, Minnes, and Outlette-Kintz (2004) found that 92% of the participants were described by caregivers as 'vulnerable to manipulation', which the authors relate to issues such as false confessions and acquiescence. Moreover, two small pilot studies demonstrate heightened suggestibility in children with FASD (Brown, Gudjonsson, & Connor, 2011; Gruppuso, 2011). Hence, the deficits in IQ, memory, and executive function exhibited by children with FASD may place this population at heightened risk for interrogative suggestion.

Intelligence and FASD

Prenatal alcohol abuse is the most common identifiable cause of mental retardation in children (National Institute on Alcohol Abuse and Alcoholism, 1990). According to Rasmussen, Horne, and Witol (2006), the average IQ score of children with FASD is a standard score of 80.9. Furthermore, IQ scores varied from a standard score of 20 (Severe or Profound Mental Retardation) to 105 (average intelligence) (Streissguth, Aase, Clarren, Randels, LaDue, & Smith, 1991). This range of intellectual abilities is

believed to be the result of a dose-dependent relationship, such that the severity of the intellectual disability increases with higher levels of alcohol exposure (Jacobson & Jacobson, 1994). However, this relationship does not always hold true, as intellectual disability can occur even in less severe cases of prenatal alcohol exposure (Mattson, Riley, Gramling, Delis, & Jones, 1997).

The link between decreased IQ and FASD is also supported by neuroimaging research. Magnetic resonance imaging (MRI) studies in children and adolescents with FASD reveal reductions in frontal and parietal lobes, and to a lesser degree temporal and occipital lobes. Regional increases in gray matter density and decreases in white matter volume and organization was also noted (Archibald, Fennema-Notestine, Gamst, Riley, Mattson, & Jernigan, 2001; Sowell et al., 2002; Astley et al., 2009b; Astley et al., 2009c). The authors theorize these differences are implicated in the behavioral and cognitive impairments displayed by this population, including general intelligence. Further, research demonstrates that a higher frequency of facial anomalies in FAS is related to more severe midline brain anomalies (Swayze et al., 1997) as well as to lower IQ (Mattson et al., 1997). This association between IQ and midline brain abnormalities is important given that individuals with FASD commonly display smaller, displaced midline structures, such as the corpus callosum (Sowell, Mattson, Thompson, Jernigan, Riley, & Toga, 2001). This is particularly relevant to discussions concerning interrogative suggestibility because suggestibility research has established that children with mild and moderate intellectual disability (ID) are more suggestible than children without ID (Gudjonsson & Henry, 2003; Henry & Gudjonsson, 1999, 2007; Young et al.,

2003). Hence, the deficits in IQ exhibited by children with prenatal alcohol exposure may confer a vulnerability to suggestion.

Memory and FASD

As part of a longitudinal prospective study, 462 children with FASD were assessed at age 14 using the Seashore Rhythm Test and the Stepping Stone Maze to measure working memory (Streissguth, Barr, Olson, Sampson, Bookstein, & Burgess, 1994). Both measures indicated significant deficits, indicating poor ability to hold and manipulate information in mind. Another study of 8 to 17-year-old children with confirmed prenatal alcohol exposure demonstrated profound learning and declarative memory deficits as assessed using 20-word lists and comparing free recall, cued recall and recognition scores to control children (Mattson & Riley, 1999). Similarly, children with FAS between the ages of 5 and 16 performed significantly worse than controls on the California Verbal Learning Test-Children's Version (CVLT-C), a verbal learning task that measures immediate, delayed and recognition memory (Mattson, Riley, Delis, Stern, & Jones, 1996). Furthermore, the children with FAS tended to make more perseverative and intrusion errors, indicating difficulty with learning and recalling verbal information. In a comprehensive exploratory study of adolescents with FAS ages 14-16, Olson, Streissguth, Sampson, and Bookstein (1998) administered multiple tests to assess several aspects of memory: Digit Span Subtests from WISC-R (short term auditory memory; working memory), Seashore Rhythm Test (short-term auditory memory), Sequence Learning Task (procedural and declarative memory), Spatial-Visual Reasoning Task (visual-spatial memory), and the Stepping Stone Maze Test (visual-spatial memory). Significant deficits were demonstrated in areas of short-term auditory memory, working

memory, visual-spatial memory, and declarative memory, but not procedural memory. This indicates that declarative memory, which includes episodic memory (memory for events and experiences), is impaired, whereas procedural memory may be spared.

Based on functional MRI (fMRI) research indicating at least a partial dependence of verbal working memory on the cerebellum in young adults (Desmond, Gabrieli, Wagner, Ginier, & Glover, 1997), O'Hare et al. (2005) investigated the cerebellum in the brains of alcohol-exposed individuals. These authors found that the cerebellar vermis was displaced and reduced in size, and further, that this dysmorphology was negatively correlated with performance on the CVLT-C, a verbal memory task. Research also indicates reductions in volume of the caudate nucleus of individuals with prenatal alcohol exposure after correcting for overall brain size (Astley et al., 2009b; Mattson, Riley, Sowell, Jernigan, Sobel & Jones, 1996), which predicted performance on neuropsychological measures of verbal memory, as measured by the CVLT-C (Mattson, Riley, Archibald & Jernigan, 2001).

The hippocampus is another brain region involved in both the synthesis of newly learned material as well as retrieval processes, and is thought to play a large role in episodic (Desgranges, Baron, & Eustache, 1998) and spatial memory (McClelland & Goddard, 1996). Evidence from MRI findings suggest significant morphological left-right asymmetry of the hippocampus in children with FAS (Riikonen, Salonen, Partanen, & Verho, 1999), indicating abnormalities in the brain region required for episodic and spatial memory. Finally, the development of episodic memory is linked to the maturation of the frontal cortex (Wheeler, Stuss, & Tulving, 1997), as the frontal lobes are heavily involved in both the encoding and retrieval of episodic memories (for a review see

Tulving, 2002). In particular, fMRI reveals consistent activation of dorsal prefrontal cortex during two episodic memory tasks (Fletcher, Shallice, Frith, Frackowiak, & Dolan, 1998). However, in children and adolescents with heavy prenatal alcohol exposure, regions of the frontal cortex, namely the dorsal and orbital areas, are considerably reduced in size compared to controls, which may negatively effect episodic memory and account for the mnemonic impairments as demonstrated by neuropsychological measures (Astley et al., 2009b; Sowell et al., 2002). In addition, during a memory task, children with FASD show a decrease in overall frontal cortex functional activity (inferior and middle frontal gyrus, right dorsolateral prefrontal cortex) with increasing task difficulty while control children demonstrate the opposite pattern, suggesting brain areas involved in normal memory are impaired in children with FASD (Astley et al., 2009a; Malisza, Allman, Shiloff, Jakobson, Longstaffe, & Chudley, 2005).

In general, research has found that weaker memory correlates with higher suggestibility (Calicchia & Santostefano, 2004; Lee, 2004). In particular, episodic memory is weak in children with FASD (Olson et al., 1998) and episodic memory is strongly related to suggestibility (Alexander et al., 2002; McFarlane et al., 2002; Scullin et al., 2002; Templeton & Wilcox, 2000). Due to the deficits on neuropsychological measures of memory and abnormalities in brain regions known to support memory function revealed through neuroimaging techniques, alcohol-exposed children are potentially more vulnerable to suggestion. Indeed, a small pilot study recently found a significant negative correlation between memory for the GSS2 story and suggestibility as measured by Yield and Shift in a sample of 8 children with FASD (Gruppuso, 2009).

Overall, research conducted thus far indicates an association between individuals with FASD and weaker memory, and between weaker memory and heightened suggestibility.

Executive Functioning and FASD

Children with prenatal alcohol exposure may display multiple signs of executive dysfunction such as impaired planning, bad judgment, inability to delay gratification, poor impulse control, lack of future orientation, disorganization, and inability to focus and concentrate (Page, 2002). Mattson, Goodman, Caine, Delis, and Riley (1999) utilized subtests from the Delis-Kaplan Executive Function Scale (D-KEFS) to assess executive domains. This study found that in comparison to typically developing peers, children aged 8 to 15 years with prenatal alcohol exposure demonstrate significant deficits on executive tasks involving response inhibition (Stroop test), planning (tower test), cognitive flexibility (trail making test), and concept formation and reasoning (word context test). Another study used a classic executive functioning test, the Wisconsin Card Sorting Task (WCST), to assess executive skills in 7 to 8-year-olds. The WCST requires inhibition, set shifting, and the use of feedback to modify behavior. Results indicate that the FASD group completed significantly fewer categories than did typically developing children (Coles, Platzman, Raskind-Hood, Brown, Falek, & Smith, 1997). A second study supported these findings in 9 to 18-year-olds, demonstrating that on the WCST task, the children with FASD completed fewer categories and made more perseverative errors than typically developing children (Kodituwakku, Handmaker, Cutler, Weathersby, & Handmaker, 1995). These authors also found that children with FASD performed much lower than control children on the Children's Executive Functioning Scale, a behavioral measure of inhibition, problem-solving, initiative, motor

planning, and social appropriateness (Kodituwakku, May, Clericuzio, & Weers, 2001b). Similarly, Mattson and colleagues (1996) found that in addition to deficits in verbal memory on the CVLT-C, children aged 5 to 16 with FAS had more difficulty discriminating target words from distracter words (false-positive errors), and made a higher number of intrusion and perseverative errors. Mattson and Riley (1998) hypothesize that these deficits in response inhibition lead to intrusion, perseveration and false-positive errors.

Evidence from imaging studies also supports the association between executive deficits, especially inhibition, and prenatal alcohol exposure. As mentioned, MRI studies reveal reductions in frontal and parietal lobes, (Archibald et al., 2001; Sowell et al., 2002), and these anomalies are consistent with executive functioning deficits in children with FASD such as reduced response inhibition, poor planning, and cognitive inflexibility (Kodituwakku et al., 2001a). Functional neuroimaging has also revealed abnormalities in frontal-striatal blood oxygen level-dependent (BOLD) response patterns in alcohol-exposed children and adolescents aged 8 to 18 during the inhibitory trials of a Go/No Go task, which requires the individual to withhold a motor response. Specifically, children with FASD showed increased BOLD response in prefrontal cortical regions (left medial and right middle frontal gyri) and decreased BOLD response in the caudate nucleus as compared to typically developing peers (Fryer, Tapert, Mattson, Paulus, Spadoni, & Riley, 2007). Moreover, reductions in the volume of the caudate nucleus predict an increased number of perseverative responses as measured by the WCST and false-positives on the CVLT-C (Mattson et al., 2001). Research also suggests a relationship between executive functioning deficits and corpus callosum dysmorphology.

The shape of the corpus callosum is significantly more variable in individuals with FASD than typical individuals (Bookstein, Sampson, Connor, & Streissguth, 2002; Bookstein, Sampson, Streissguth, & Connor, 2001), and there is evidence that callosal dysmorphology is associated with an executive deficit, as reflected by scores on the WCST (Bookstein, Streissguth, Sampson, Connor, & Barr, 2002).

Clearly, individuals with prenatal alcohol exposure demonstrate impairment on neuropsychological tests of executive function and evidence structural and functional differences in areas of the brain hypothesized to support executive functions. Executive dysfunction is associated with an increased risk of interrogative suggestibility (for example, Alexander et al., 2002), and consequently, children with FASD may be at pronounced risk for suggestibility. Referring to the hypothesis proposed by Karpinski and Scullin (2009), typical development of executive skills might decrease the association between inhibition and suggestibility; however, in cases of atypical executive development, such as children with FASD, vulnerability to suggestion would remain high.

FASD: Suggestibility and Issues with the Law

Research has shown that individuals with FASD experience adverse life outcomes, including greater involvement with the criminal justice system. Streissguth, Bookstein, Barr, Sampson, O'Malley, and Young (2004) administered a comprehensive Life History Questionnaire to knowledgeable informants for 415 individuals with FASD aged 6 to 51. The questionnaire revealed that 60% had been in trouble with the law, defined as being arrested, charged, convicted or in trouble with authorities, and 50% had been confined in detention, jail, prison, and/or a psychiatric or alcohol/drug inpatient

setting. Further, in a Canadian sample of youth aged 12 to 18 that committed a criminal offense, 23% had a diagnosis of FASD (Fast, Conry, & Loock, 1999). This indicates that the prevalence of FASD youth in the criminal justice system is disproportionately high, recalling that the highest estimates of FASD in the general population are 2-5% (May et al., 2009). Empirical evidence from a 4-year study on secondary disabilities in individuals with FASD revealed that 14% of 6-11-year-olds, 61% of 12-20-year-olds, and 58% of 21-51-year-olds had been in trouble with the law (Streissguth, Barr, Kogan, & Bookstein, 1996). Researchers have proposed that individuals with FASD are potentially at increased risk of interrogative suggestibility due to cognitive and behavioral deficits and that these deficits could, at least in part, be serving to increase involvement with the justice system. In a recent review article, Fast and Conry (2009) identify multiple areas of challenge that an individual with FASD faces in the legal system, and state: ‘individuals with FASDs... are more suggestible and tend to acquiesce to statements and questions by police and lawyers’ (p. 254).

Indeed, Brown et al. (2011) present preliminary data from a small study investigating the role of suggestibility as a psychological vulnerability in adult defendants with FASD ($N = 7$) who were involved in either a pre-trial or post-conviction adjudication process, and compared the suggestibility of this group to four control groups from other studies: 1) non-forensic adults with FASD; 2) forensic adults without FASD; 3) typical adults from the general population in the United States; and, 4) typical adults from the general population in the United Kingdom. Results indicate that the forensic FASD sample scored significantly higher on a measure of Yield than both groups of typical adults. In addition, the forensic FASD sample demonstrated significantly higher

Shift scores than the forensic adults without FASD and both general population groups. However, there were no differences between forensic and non-forensic adults with FASD on Yield or Shift. Overall, this small study supports the notion that individuals with FASD are at risk for heightened suggestibility.

Given that preliminary research indicates a vulnerability to suggestion in adults with FASD, combined with the disproportionately high prevalence of children with FASD in the criminal justice system, the next investigate step is to determine if youth with FASD are indeed more suggestible. In light of research indicating that suggestibility is moderately stable over time (Lehman, McKinley, Thompson, Leonard, Liebman, & Rothrock, 2010; Melinder, Scullin, Gravvold, & Iverson, 2007), if it is the case that adults with FASD are more suggestible, they are likely also at risk of interrogative suggestibility at younger ages. Further, given that younger children are more suggestible (Danielsdottir et al., 1993; Melinder et al., 2006; Redlich & Goodman, 2003), it may even be the case that children with FASD are *more* suggestible than adults with FASD. If it is the case that youth with FASD display heightened rates of interrogative suggestibility, it has important consequences for future interrogative interactions, as particular care will be necessary when interviewing this population in a juvenile forensic setting so that elicited information is accurate.

Current Study and Research Questions

The relationship between prenatal alcohol exposure and interrogative suggestibility has not yet been investigated in children, and thus it is unknown whether children with FASD are more vulnerable to suggestion. Furthermore, although research has examined the extent to which certain children acquiesce to misleading questions and

change their answers following negative feedback as indicated by a verbal response, research has not explored whether or not the suggested information, once ceded to, is *internally* accepted as true. Hence, the current study aimed to address the following research questions:

1. Are there significant correlations between age, IQ, memory, inhibitory control, GSS2 Immediate recall, GSS2 Delayed recall, GSS2 Yield, GSS2 Shift, GSS2 Total suggestibility, and Internalization, and if so, does the strength of these correlations differ between alcohol exposed and typical samples of children?
2. Are there significant differences in levels of suggestibility between children with FASD and typical children?
3. Once a child cedes to a misleading question, is the suggested material internalized?

Hypotheses

1. Children with FASD will demonstrate higher rates of interrogative suggestibility compared to typically developing children, consistent with previous clinical and informal observation.
2. The internalization of suggested information will be greater for the sample of children with FASD, given that they are at higher risk of cognitive deficits that may affect their ability to differentiate between details of the story and suggested material.

Methods

Participants

Children were included in the study if they had guardian consent to participate. In the selection of participants, exclusionary criteria primarily included factors that might interfere with performance on the measures: lack of English fluency, significant visual or hearing impairment, previous psychiatric hospitalization or current diagnoses of psychiatric disorders (e.g. autism), and a history of head trauma with loss of consciousness. In addition, the psychological measures used in the study were only appropriate for certain age ranges; hence, children less than 6:0 or over 16:11 years of age were excluded.

Participants comprising the FASD sample were recruited in a number of ways. Meetings were held with FASD key workers (who are assigned as family advocates when a child is diagnosed with FASD in British Columbia), social workers, and team leaders at centers on Vancouver Island that provide services to children with FASD and their families, including FASD Community Circle Victoria, Metis Community Services, Nil'tu'ó Child and Family Services, Victoria Native Friendship Center, Foster Parent Support Services Society of British Columbia (BC), and Parent Support Services Society of BC. At these meetings, brochures were provided for future distribution by the key workers, social workers, and team leaders to families identified as having a child with FASD. In addition, posters were created and displayed on bulletin boards and at the main entrances of these centers. The brochures and posters included a description of this project and directed guardians to a website promoting research on FASD at the University of Victoria which included a 'Volunteer Registration Form' for guardians to

complete if they were interested in having their child participate in the research study. Guardians that completed the form were contacted and invited to participate in the study. Participants were also made aware of the study and the website via an email based listserv for advocates for and families impacted by FASD on Vancouver Island. Once a potential participant was identified, verbal confirmation from guardians indicated that all children in the FASD group had been given a formal diagnosis by an appropriately qualified diagnostic team. The final sample of alcohol exposed children was comprised of 7 children (3 girls and 4 boys) aged 7.35 to 13.76 years ($M = 10.62$, $SD = 2.13$).

The typically developing sample in the present study was comprised of 14 children (10 girls and 4 boys), who ranged in age from 6.07 to 13.45 years ($M = 10.02$, $SD = 2.27$). The group was recruited through posters in local community libraries and recreation centers, and through listings on local Internet sites such as Craigslist, kijiji, and Kids in Victoria.

Measures

Gudjonsson Suggestibility Scale, Form 2 (GSS2)

The GSS1 and GSS2 (a parallel form) are measures frequently employed to investigate suggestibility in children and adults (Gudjonsson, 1984, 1987b). Although these measures were both created in England, the GSS2 uses less British-specific names, places, and vocabulary. In addition, the narrative content of the GSS2 is simpler than the content in the original version, and for this reason the GSS2 is preferred for research with children (Gudjonsson, 2003). Hence, the present study employed the GSS2 as a measure of interrogative suggestibility.

Administration of the GSS2 involves listening to narrative passage about a boy saved from falling off his bicycle. Immediately following the oral presentation, participants are instructed to recall as much as possible about the narrative (Immediate recall). Approximately 40-50 minutes later, participants are again instructed to recall as much as possible about the narrative (Delayed recall). Participants are then told: 'I am going to ask you some questions about the story. Try to be as accurate as you can'. A series of 20 closed selection questions (either/or questions, such as 'was the car red or blue') and closed yes/no questions are then asked; fifteen questions are misleading (e.g., 'Was the husband a bank director?' when the husband's occupation was not specifically mentioned), and five questions are nonleading. After participants answer the 20 questions, negative feedback is given in the form of: 'you have made a number of errors. It is therefore necessary to go through the questions once more, and this time try to be more accurate'. This was stated firmly, but not sternly, as per administration instructions (Gudjonsson, 2003). Participants are then re-asked the same 20 questions.

In general, the researcher adjusted her behavior during the administration of the GSS2 as compared to during the administration of the other measures in an effort to emphasize the seriousness and importance of this particular task. Specifically, the researcher made slightly less eye contact and kept her tone more neutral (i.e. spoke with less variable pitch). In addition, the researcher provided fewer encouraging or positive remarks to the child and provided less frequent positive facial expressions (i.e. smiling, laughing).

The GSS2 generates two main suggestibility scores. First, the extent to which participants cede to the first set of fifteen misleading questions provides a Yield score

with a possible range of 0-15. Second, the number of distinct response changes to the questions after the negative feedback is given provides a Shift score with a possible range of 0-20. Distinct response changes included examples such as: stop sign to traffic lights, stop sign to don't know (DK), stop sign to both, stop sign to neither, yes to no, yes to DK, no to DK, and changes in the reverse order. On both measures, higher scores indicate increased suggestibility. All answers were taped and transcribed verbatim to ensure accurate scoring. The sum of the Yield and Shift scores provide an overall Total suggestibility score, with a possible range of 0-35.

To determine whether or not the child internalized any suggested information, an adaptation of the GSS2 was undertaken. First, the child listened to a recorded version of the narrative alone in the room (as opposed to the examiner reading the story aloud to the child). After the Immediate recall, 40-50 minute delay, Delayed recall, and answering the series of 20 questions twice (Yield and Shift), the examiner pretended to look over the answers and then said, '*Oh no, you listened to a different story than the one I thought you listened to. That means we have to go through the questions one more time, because you need to answer the questions how you really think they should be answered.*' Hence, the child proceeded to answer the series of 20 questions for a third time. The internalization score was expressed as the total number of suggestible responses the child provided, with a possible range of 0-15.

The GSS2 is a reliable measure of an individual's interrogative suggestibility with a standardized scoring system, and high interrater reliability (0.97-0.99) and temporal consistency (0.73-0.93). The internal consistency for the Yield and Shift subscales were 0.87 and 0.79, respectively (Clare, Gudjonsson, Rutter, & Cross, 1994). The GSS2 has

been used with many populations, including children with mild and moderate intellectual difficulties, children with ADHD, psychiatric inpatients, institutionalized adolescents, and typically developing children.

Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV)

The WISC-IV is a standardized battery of subtests designed to measure intelligence in children ages 6:0 to 16:11 (Wechsler, 2004). For the purposes of this study, only the Block Design and Vocabulary subtests were administered to provide an estimate of overall intelligence. The subtest scores were converted into an estimated IQ based on the formula outlined by Sattler (2008a), on which larger scores indicate higher IQ. In combination, these two subtests have good reliability ($r = 0.92$) and validity ($r = 0.87$), and correlate highly with the overall IQ score obtained from administering the entire WISC-IV (Sattler, 2008b).

Wide Range Assessment of Memory and Learning-2 (WRAML-2)

The core verbal and visual memory subtests from the WRAML-2 were utilized to examine declarative memory (Sheslow & Adams, 2003). Verbal subtests include recalling stories and a list of words. Visual subtests include recalling geometric shapes and details of picture scenes. All four subtests were combined into a Screening Memory Index score to provide an overall estimate of memory abilities, on which higher scores indicate better verbal and visual memory. The index score is presented as a standard score ($M = 100$, $SD = 15$). Normative data are provided for individuals aged 5:0 to 90:11. Reliabilities for the four subtests used from the WRAML-2 range from 0.85 to 0.94. The WRAML-2 has demonstrated support for use in various clinical populations (Alzheimer's

disease, Parkinson's disease, alcohol abuse, learning disorder, and traumatic brain injury).

Test of Everyday Attention for Children (TEA-Ch)

Inhibitory abilities were assessed by the Opposite World subtest from the TEA-Ch (Manly, Robertson, Anderson, & Nimmo-Smith, 1999), on which the child is presented with two cards, one at a time, that display random sequences of the digits 1 and 2. The child is instructed to say the opposite of what is printed by inhibiting the automatic response (i.e., when '1' is seen the correct response is 'two' and when '2' is seen the correct response is 'one'). If a child makes a mistake they are encouraged to go back and correct their response. Following a practice trial, the time taken to complete the two cards is summed and converted into a scaled score ($M = 10$, $SD = 3$). Higher scores indicate stronger inhibitory control. The Opposite World subtest is normed separately by gender for children ages 6:0 to 16:11, and demonstrates high reliability ($r = 0.85$).

Procedure

All tests were individually administered to each child within a single testing session, with a total approximate testing time of 60 minutes per child. The order of test administration was consistent for all children: GSS2 Immediate recall, WISC-IV Block Design and Vocabulary, the WRAML-2 Screening Memory Index, TEA-Ch Opposite Worlds, GSS2 Delayed recall, GSS2 Yield, GSS2 Shift, and Internalization. The testing took place in a quiet room at the University of Victoria Psychology Clinic. Children received a small toy at the end of the session and the guardian received a \$5.00 honorarium. Ethics approval for the research was obtained from the University of

Victoria Human Research Ethics Board (Protocol Number 11-427) and the research was conducted in accordance to these standards.

Results

Data Screening

All analyses were computed using IBM SPSS Statistics version 19.0.0 (SPSS Inc., IBM company, 2010). There were no missing data from the alcohol exposed or typically developing samples.

Descriptive Statistics

Independent *t*-tests confirmed that the groups did not differ significantly with respect to chronological age ($t(19) = -0.58, p = 0.571, d = 0.28$). The groups did differ significantly on measures of intelligence ($t(19) = 3.57, p < 0.01, d = -1.74$), memory ($t(19) = 2.39, p < 0.05, d = -1.16$), and inhibitory control ($t(19) = 2.97, p < 0.01, d = -1.66$), with controls outscoring children with FASD. No significant differences emerged between groups on GSS2 Immediate or Delayed recall ($t(19) = 1.83, p = 0.083, d = -0.89$; $t(19) = 1.50, p = 0.150, d = -0.73$, respectively). Paired sample *t*-tests revealed that although there was no difference in the recall of GSS2 information before or after a delay (i.e. Immediate recall compared to Delayed recall) in the alcohol exposed sample ($t(6) = 0.09, p = 0.930, d = 0.03$), significantly less information from the story was recalled after a delay in the typically developing sample ($t(13) = 2.91, p < 0.05, d = 0.78$).

Correlations

Pearson's bivariate correlations among variables for each group are displayed in Table 1. In the sample of children with FASD, Memory and Inhibition were positively

correlated, Inhibition and Delayed recall were positively correlated, Yield and DK responses were negatively correlated, and Shift and Total suggestibility were positively correlated. For the control sample, Age and Total suggestibility were negatively correlated, IQ and Memory were positively correlated, IQ and Immediate recall were positively correlated, IQ and Delayed recall were positively correlated, Memory and Immediate recall were positively correlated, Memory and Delayed recall were positively correlated, Immediate recall and Delayed recall were positively correlated, Yield and Total suggestibility were positively correlated, Yield and Internalization were positively correlated, and Shift and Total suggestibility were positively correlated. It is important to note that the significant correlations between Age and Yield, Age and Total suggestibility, Age and Internalization, IQ and Memory, IQ and Inhibition, IQ and Immediate recall, IQ and Delayed recall, Memory and Inhibition, Memory and Immediate recall, Memory and Delayed recall, Immediate recall and Delayed recall, Yield and Total suggestibility, Yield and Internalization, and Yield and DK responses in the *entire* sample was greatly increased or decreased when the correlations were examined within each group. This result highlights the importance of analyzing bivariate correlations separately for each group.

Table 1 Intercorrelations among variables for the FASD sample (below the diagonal, $n = 7$) and the typical sample (above the diagonal, $n = 14$)

		Age	IQ	Mem	Inh	Imm Recall	Delay Recall	Yield	Shift	Total Sugg	Intern	DK
Age	Pearson Correlation	1	-.197	.047	-.162	.338	.229	-.440	-.301	-.541*	-.483	.094
IQ	Pearson Correlation	.136	1	.707**	.045	.715**	.817**	-.004	-.284	-.204	.030	-.023
Mem	Pearson Correlation	.419	.474	1	.500	.613*	.654*	.023	-.360	-.245	-.065	-.012

Inh	Pearson Correlation	.439	.435	.788*	1	-.057	.005	-.220	.226	.004	-.293	-.081
Imm Recall	Pearson Correlation	.553	-.353	.387	.402	1	.958**	-.352	-.365	-.523	-.125	.113
Delay Recall	Pearson Correlation	.460	.085	.544	.874*	.693	1	-.372	-.305	-.495	-.121	.044
Yield	Pearson Correlation	-.582	-.279	-.019	.279	-.024	.354	1	-.062	.686**	.700**	.207
Shift	Pearson Correlation	-.055	.583	-.082	.310	-.133	.318	.059	1	.684**	-.107	.203
Total Sugg	Pearson Correlation	-.333	.353	-.079	.398	-.124	.442	.542	.871*	1	.433	.300
Intern	Pearson Correlation	-.554	-.206	.344	.179	-.023	.051	.696	-.383	.020	1	.024
DK	Pearson Correlation	.509	.484	.038	-.197	-.280	-.417	-.924**	.022	-.437	-.659	1

* $p < 0.05$; ** $p < 0.01$

Suggestibility: Yield, Shift, Total Suggestibility

Table 2 summarizes the means and standard deviations for the suggestibility variables measured in the current study. There were no significant differences between groups on Yield ($t(19) = 1.71, p = 0.104; d = -0.83$), Shift ($t(19) = -1.01, p = 0.327; d = 0.49$), or Total Suggestibility ($t(19) = 0.29, p = 0.777, d = -0.14$).

Table 2 Comparison of means and standard deviations on GSS2 between children with FASD ($n = 7$) and control children ($n = 14$)

	FASD ($n = 7$) Mean (SD)	Controls ($n = 14$) Mean (SD)	Cohen's d
GSS2 Yield	6.00 (2.58)	8.14 (2.77)	-0.83
GSS2 Shift	9.14 (4.41)	7.57 (2.77)	0.49
GSS2 Total Suggestibility	15.14 (5.24)	15.71 (3.79)	-0.14

Given the relatively small sample sizes of the groups, and the unanticipated finding of higher mean suggestibility scores on Yield and Total suggestibility in the

control group, it seemed reasonable to compare GSS2 scores from the children with FASD and control children to GSS2 scores from another study that used similarly aged control children. Brown et al. (2011) used the same approach of comparing to previously collected data on typically developing controls in their study of suggestibility in adults with FASD. The current study utilized mean GSS2 scores collected from a larger control sample of typically developing children, aged 9-13 years ($n = 50$, $M = 11.08$, $SD = 1.00$) (Miles, Powell, Gignac, & Thomson, 2007). A survey of the literature determined this sample was the most closely matched in age to the total sample of children in the current study (range = 6-13 years, $M = 10.22$, $SD = 2.19$). Table 3 presents the results of one-sample t -test comparisons between the typically developing children and children with FASD in the present study to the mean suggestibility scores of the normative control data (Miles et al., 2007). The standard error of the means were based on the variability estimates from each of the samples in the present study.

For the measure of Yield, there was no significant difference between the children with FASD compared to the larger control group ($t(6) = 0.68$, $p = 0.524$, $d = 0.24$). However, the current control group scored significantly higher than the larger normative sample ($t(13) = 3.79$, $p < 0.01$, $d = 1.02$). Shift was significantly higher in both the alcohol exposed and control samples compared to the larger control group ($t(6) = 2.51$, $p < 0.05$, $d = 1.52$; $t(13) = 3.53$, $p < 0.01$, $d = 1.02$, respectively). Finally, Total suggestibility was also significantly higher in both the current FASD and control samples compared to the larger control group ($t(6) = 2.44$, $p < 0.05$, $d = 1.23$; $t(13) = 5.34$, $p < 0.01$, $d = 1.36$, respectively). Of note, the data substantiate that the current control group

scored significantly higher on all suggestibility components than seen in a study with a larger control group.

Table 3 Comparison of GSS2 means from children with FASD ($n = 7$) and control children ($n = 14$) to a larger normative sample ($n = 50$)

	FASD ($n = 7$) Mean (SD)	Controls ($n = 14$) Mean (SD)	Miles et al. controls ($n = 50$) Mean (SD)
GSS2 Yield	6.00 (2.58)	8.14 (2.77)**	5.34 (2.78)
GSS2 Shift	9.14 (4.41)*	7.57 (2.77)**	4.96 (2.54)
GSS2 Total suggestibility	15.14 (5.24)*	15.71 (3.79)**	10.30 (3.82)

* $p < 0.05$; ** $p < 0.01$

Response Style

A ‘don’t know’ (DK) score was obtained for each child, which reflected the sum of ‘I don’t know’, ‘I can’t remember’, and ‘I’m not sure’ responses given during the Yield and Shift trials. This DK measure is not part of the standard GSS1 or GSS2 procedure, but was developed for the purpose of the present study to test for group differences, given that observationally these responses were noted to be unusually high in the group of children with FASD. The frequency of DK responses have also been analyzed in relation to suggestibility in other clinical groups (Coxon & Valentine, 1997; Gudjonsson, Young, & Bramham, 2007).

Levene’s test for equality of variances was significant ($F = 15.25, p < 0.01$), indicating the variance of scores within each group was significantly different. A non-parametric test was therefore used to examine differences between groups. A Mann Whitney U -test revealed the FASD group provided significantly more DK responses than the control group ($U = 22.00, p < 0.05, d = 1.17$).

Suggestibility in Relation to Question Format

Based on research that indicates closed questions elicit a higher frequency of suggestible responses in comparison to open questions (Snook & Keating, 2011; Wright & Alison, 2004), the present study sought to examine whether the format of the closed question itself impacted suggestibility.

The GSS2 employs two types of misleading closed question formats: five selection questions (e.g., Did the couple have a dog or a cat?) and ten yes/no questions (e.g., Was the husband a bank director?). Analysis of the total number of suggestible responses given on the Yield and Shift trials in response to selection questions by children with FASD ($M = 7.86$, $SD = 2.48$) compared to control children ($M = 8.14$, $SD = 1.99$) reveal that there was no between group difference ($t(19) = 0.29$, $p = 0.778$, $d = -0.14$). There was also no difference in the number of suggestible responses provided to yes/no questions between the alcohol exposed ($M = 8.29$, $SD = 2.98$) and typically developing ($M = 10.43$, $SD = 3.86$) samples of children ($t(19) = 1.28$, $p = 0.214$, $d = -0.62$). After correcting for the difference in the total number of selection questions compared to the total number of yes/no questions on the GSS2, a paired samples t -test revealed that the entire sample answered selection questions in a suggestible manner ($M = 8.05$, $SD = 2.11$) significantly more often than yes/no questions ($M = 4.86$, $SD = 1.83$) ($t(20) = 7.61$, $p < 0.01$, $d = 1.66$). There was a positive correlation between the number of selection and yes/no questions answered in a suggestible manner ($r = 0.533$, $p < 0.05$).

Internalization

The amount of suggested material from the GSS2 that was internalized by each child, or the extent to which each child believed the suggested material was from the original story, was assessed. This score represented the number of misleading questions answered in a suggestible manner on trial 3. Total internalization scores did not differ between FASD ($M = 8.86$, $SD = 3.34$) and typical ($M = 9.21$, $SD = 3.56$) samples of children ($t(19) = 0.22$, $p = 0.827$, $d = -0.11$).

Given that the number of suggestible responses provided to selection questions was significantly higher than the number of suggestible responses provided to yes/no questions when considering the entire sample, internalization scores were examined in a similar manner. Internalization of material posed through selection questions by children with FASD ($M = 4.43$, $SD = 1.13$) compared to control children ($M = 4.07$, $SD = 1.44$) indicate that there was no difference between groups ($t(19) = -0.57$, $p = 0.574$, $d = 0.28$). There was also no difference in the internalization of suggested material posed through yes/no questions between the alcohol exposed ($M = 4.57$, $SD = 2.88$) and typically developing ($M = 5.07$, $SD = 2.79$) samples of children ($t(19) = 0.38$, $p = 0.706$, $d = -0.23$). After correcting for the difference in the total number of selection questions compared to the total number of yes/no questions, a paired samples t -test revealed that the entire sample internalized suggested material from selection questions ($M = 4.19$, $SD = 1.33$) significantly more than suggested material from yes/no questions ($M = 2.45$, $SD = 1.38$) ($t(20) = 5.65$, $p < 0.01$, $d = 1.32$). Internalized suggested material from selection questions was positively correlated to internalized suggested material from yes/no questions ($r = 0.456$, $p < 0.05$).

A paired samples *t*-test on the entire sample also revealed that there was no difference in the average number of selection questions answered in a suggestible manner ($M = 4.02$, $SD = 1.05$) compared to the amount of internalized suggested material from selection questions ($M = 4.19$, $SD = 1.33$) ($t(20) = -0.92$, $p = 0.367$, $d = -0.20$). These two variables were positively correlated ($r = 0.782$, $p < 0.01$). Similarly, there was no difference in the average number of yes/no questions answered in a suggestible manner ($M = 2.43$, $SD = 0.92$) compared to the amount of internalized suggested material from yes/no questions ($M = 2.45$, $SD = 1.38$) when considering the entire sample ($t(20) = -0.10$, $p = 0.918$, $d = -0.02$). Again, these two variables were positively correlated ($r = 0.651$, $p < 0.01$). Figure 1 displays the corrected mean number of questions answered in a suggestible manner compared to the amount of internalization by question format.

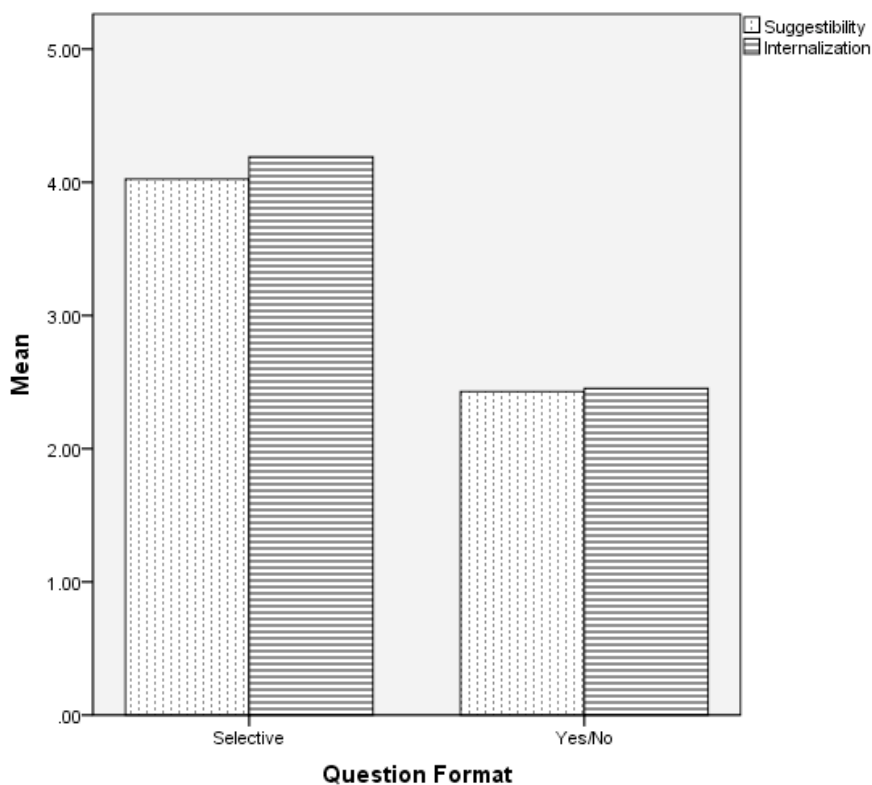


Figure 1 Mean suggestibility and internalization scores by question type for the entire sample ($n = 21$)

Post Hoc Power Analysis

Power for the independent *t*-tests reported above for the current study ($\alpha = 0.05$, two-tailed) ranged from less than 12% to 44%. This means that the probability of correctly rejecting a false null hypothesis was extremely low due to the small samples sizes attained in this study. A post hoc power analysis was conducted to determine the number of subjects that would be necessary for the study to have a 90% chance of detecting differences between the groups if they do indeed exist (i.e., setting Type II error rate to .90). This power analysis was based on the means and standard deviations reported by Brown et al. (2011) for their study on suggestibility in adults with FASD versus typically developing adults with which the null hypothesis was rejected. Based on this level of power, samples sizes for the present study should have included at least 24 children in each group. Alternatively, research has recommended that using Cohen's (1988) 'large' effect size of 0.8 ($d = 2.8$) is appropriate for theoretically motivated clinical neuropsychological research to ensure reliable detection of an effect that truly exists in a population (Bezeau & Graves, 2001). Estimated sample sizes using Cohen's (slightly lower) power level indicates each group should have contained approximately 23 children. Hence, post hoc comparisons of achieved power in the present study to the power in Brown et al.'s study (2011) and to Cohen's (1988) guideline indicate sample sizes should have been much higher in order to be able to detect between group differences.

Discussion

Suggestibility: Yield, Shift, Total Suggestibility

The present study examined suggestibility in children with and without prenatal alcohol exposure. In this study, children with FASD did not differ significantly from the small sample of control children on the extent to which they yielded to misleading questions (Yield), the extent to which they changed their answers following negative feedback (Shift), or the sum of these suggestibility scores (Total suggestibility). This was contrary to expectation, given that substantial research indicates: 1) low intellectual ability, poor memory, and weak inhibitory control are associated with heightened suggestibility; 2) children with FASD in the current study demonstrated significantly weaker intellectual, memory, and inhibitory control abilities; and, 3) children with FASD are clinically described as vulnerable to manipulation. Several factors may account for the failure to observe significant group differences.

First, research demonstrating a significant association between low intelligence and high suggestibility typically involves individuals with diagnoses of Mild, Moderate, or Severe Intellectual Disability (IQ 50-70, IQ 35-49, IQ < 35, respectively). For example, results of a meta-analysis by Bruck and Melnyk (2004), who define ‘children with low IQs’ as children with IQs of 70 standard score points or below, concludes: ‘although IQ is an important factor for accounting for suggestibility *difference* in samples that include children with normal and low IQs, it is not a reliable predictor of suggestibility for children with normal IQs’ (p. 961). In the present study, only two individuals, both of whom were diagnosed with FASD, had an IQ below 70 standard

score points, and the IQs of these particular individuals fell in the mild range (i.e., IQ scores were 54 and 59). Also, there were no significant correlations between IQ and suggestibility measures in either of the groups. Given that this construct was not in the 'low IQ' range in the overall sample of children with FASD ($M = 73.9$, $SD = 13.87$), the influence of intelligence on suggestibility may have been reduced, or even eliminated.

Second, despite the finding that children with FASD demonstrated significantly lower WRAML-2 memory composite scores in comparison to the control group, this memory score was not correlated to any of the suggestibility scores for either group. Also, there were no significant correlations between GSS2 Immediate and Delayed memory recall to the WRAML-2 in children with FASD, although both measures were positively correlated to WRAML-2 in the control group. Research indicates children with FASD demonstrate selective impairments on measures of verbal and nonverbal memory (Mattson & Roebuck, 2002; Pei, Rinaldi, Rasmussen, Massey, & Massey, 2008). Hence, the lack of significant correlations among memory measures in the FASD sample may reflect the fact that the GSS2 memory scores pertain strictly to the recall of verbal information while the WRAML-2 memory score is a composite score comprised of verbal and nonverbal memory tests. The WRAML-2 composite score may have combined scores reflecting unequal abilities in the FASD sample, which may have caused the memory variables to be uncorrelated. In contrast, the control group, theoretically without memory impairments, may be more likely to display similar verbal and visual memory abilities, thus explaining the correlation between memory scores in this group.

The lack of significant findings between groups on suggestibility despite the

significant difference on the WRAML-2 memory score may reflect the limited relationship between memory, as assessed by the WRAML-2, and suggestibility. Bruck and Melnyk (2004) summarized the outcomes of fourteen studies that examined correlations between traditional memory tests (such as the WRAML-2) and suggestibility scores. Out of 65 total correlations, only five were significantly related to a measure of suggestibility, with higher suggestibility associated with weaker memory. On the basis of these findings and the findings from other studies, the authors speculate that memory is only related to suggestibility when memory and suggestibility for the *same* event are compared.

Indeed, many studies show a significant negative correlation between memory and suggestibility for the same event (Marche, 1999; Pezdek & Roe, 1995). Although in the control group the Immediate and Delayed recall scores were positively correlated, the correlations were insignificant in the group of children with FASD. Further, children with FASD did not significantly differ on their recall scores before and after a delay, although typical children recalled significantly less information following a delay. It may be that this *overall* similarity on Immediate and Delayed recall scores for the FASD sample contributed to superseding differences in suggestibility.

Third, with regard to inhibition, although the control sample performed significantly better than the FASD sample, there was no significant correlation between inhibition and suggestibility in either sample. Alexander et al. (2002) proposed two potential mechanisms by which inhibitory control can decrease suggestibility. The first hypothesis is that children with better inhibitory skills are more able to inhibit distractions during the encoding phase, which permits a more accurate representation of

the event to be encoded. However, recall scores for the GSS2 story in the sample of children with FASD did not significantly differ, despite the fact that inhibitory control was significantly lower. Hence, the relatively comparable Immediate and Delayed recall scores may have acted as a protective buffer to reduce the impact of weaker inhibitory control on suggestibility. Alexander et al.'s second hypothesis is that children with stronger inhibitory abilities are better able to suppress impulsive, extraneous, or *suggested* thoughts at the time of recall. As will be discussed in depth later on, despite the low inhibitory control scores, the children with FASD adopted a DK response style significantly more often than control children, which may have operated to reduce impulsive, extraneous, or *suggested* responses to the questions, consistent with the observed negative correlation in the group with FASD between Yield and DK responses. Overall, the lack of significant differences in Immediate and Delayed recall combined with the use of a DK response style may have limited the contribution of weak inhibitory control to suggestibility in the sample of children with FASD.

Another important consideration is the type of response inhibition measured in this study. Response inhibition can be broadly differentiated into two categories: conflict tasks and verbal inhibition tasks. Commonly used conflict tasks involve the go/no-go task, on which the participant is required to press a button in response to all letters except X, or the Day-Night task (Gerstadt, Hong, & Diamond, 1994). The present study employed the Opposite Worlds subtest from the TEA-Ch, which is a measure of conflict inhibitory control. In contrast, verbal inhibition tasks require inhibition of a specific verbal response, and can be subdivided into measures of retroactive and proactive interference. An example of a verbal inhibition task is asking a participant to repeat two

sets of three words, and then asking the participant to provide only one set of words while inhibiting recall of the other set. Retroactive interference occurs if the participant provides words from the second set when asked to provide only the first set of words; proactive interference occurs if the participant provides words from the first set when asked for the second set. Roberts and Powell (2005) found that children with low retroactive interference scores were significantly less suggestible than children with high retroactive interference scores, while no relationship was found between suggestibility and the proactive interference score or performance on either of the conflict tasks.

Verbal inhibitory control tasks, specifically retroactive verbal inhibition tasks, may be better suited to assess suggestibility given that retroactive interference appears to mimic the suggestibility process. In standard suggestibility tasks, the participant first experiences an event (e.g., staged event, listening to a story), and then is asked a series of misleading questions about the event. If retroactive interference occurs, the participant would provide information from the misleading questions (i.e., suggested material) as opposed to from the original event. Retroactive interference and suggestible responses indicate that the participant has failed to inhibit provision of verbal information presented after the original information. Hence, the conflict task employed by the present study to examine the relationship between inhibition and suggestibility may not adequately assess the type of inhibitory control necessary to reduce suggestibility, and would account for the insignificant correlations between the studies measure of inhibition and suggestibility. Future investigations of factors that may predict suggestibility should include a measure of retroactive verbal inhibitory control, as this particular type of inhibition may more closely reflect suggestibility.

An even larger factor when considering the lack of significant differences for suggestibility scores between the present experimental and control groups is the limited power entailed by the study. Post hoc power analyses between the power levels observed in Brown et al.'s (2011) study and Cohen's recommended power level in comparison to the power level achieved in the present study revealed sample sizes would need to be substantially increased in order to be able to detect between group differences (23-24 children in each group). Although the initial study design proposed sample sizes of 20 in each group, due to recruitment limitations this goal was not attained.

Despite these power limitations, one important consideration is effect size measurements, which reveal the magnitude and direction of the difference between group means. Following critiques of the overreliance on a 0.05 alpha level and lack of ontological basis of dichotomous significance testing (for example, Rosnow and Rosenthal, 1989), the American Psychological Association (APA) Task Force on Statistical Inference recommended that effect size estimates *always* be reported along with *p* values (Wilkinson and APA Task Force on Statistical Inference, 1999). Calculating the experimental size of the effect is particularly important for research with small sample sizes because these studies are less likely to attain the level of power necessary to adequately detect statistically significant differences between groups.

In this study, effect size calculations revealed large mean group differences for GSS2 Immediate recall and GSS2 Delayed recall, with the FASD group recalling less information from the story before and after a delay than the control group. There was a medium effect between group means on Shift, on which the FASD sample performed worse than the control group (i.e., the children with FASD were more suggestible). The

opposite pattern was observed for Yield, on which the control sample was more suggestible than the FASD sample as reflected by a large effect size. The effect size for Total suggestibility was negligible, meaning that the combined contributions from Yield and Shift were relatively equal between groups. Indeed, in the control group Yield and Shift were both weakly correlated with Total suggestibility; in the children with FASD, the Shift score was strongly correlated with Total suggestibility. Overall, scores were in the expected direction for Shift, but not for Yield. Given the size of the observed effects, significant differences may have been revealed with larger sample sizes. Results from the current study tentatively indicate that children with FASD may be particularly sensitive to suggestion when it takes the form of critical feedback from an authority figure.

These general findings in the present study were similar to the results obtained when the suggestibility scores from the current small sample of alcohol exposed children were compared to GSS2 suggestibility scores from a larger control sample of children (Miles et al., 2007). An additional comparison group was included due to the unexpectedly high Yield and Total suggestibility scores observed the current control group. After a thorough literature review, the control group from this particular study was chosen as a comparison because the children were similar in terms of age, the sample size was substantially larger, and the GSS2 was used as one of the suggestibility measures. These comparisons revealed significant differences between the sample of children with FASD and the larger control group for Shift, but groups did not differ for Yield. This is somewhat congruent with the results obtained in the current study, on which children with FASD demonstrated a medium effect size in comparison to the small

control sample (indicating higher suggestibility) only for Shift. This is also similar to findings by Brown et al. (2011), which indicate forensic adults with FASD displayed consistently higher Shift scores compared to two general population groups and court referred individuals without FASD. In contrast, the forensic group of adults with FASD demonstrated inconsistently higher Yield scores (differences were only significant in comparison to a control group of adults from the United States, but not in comparison to a control group of adults from the United Kingdom or court referred individuals without FASD).

In addition, Total suggestibility scores in the sample of children with FASD were significantly elevated compared to the larger control sample. Similarly, Brown et al. (2011) found that the forensic group of adults with FASD demonstrated significantly higher Total suggestibility scores compared to both of the general population groups and the court referred individuals without FASD. Of note, Brown et al.'s (2011) sample of adults with FASD was the same size as the sample of children with FASD ($n = 7$), and thus suffers from the same generalizability limitations as the current study. However, the relative congruency in results from the current studies comparisons of children with FASD to two control samples and results from Brown et al.'s (2011) study provide tentative support that risk for suggestibility in children and adults with FASD is more robust in response to negative feedback, as reflected by higher Shift scores.

Indeed, Yield and Shift are hypothesized to reflect different aspects of suggestibility. Specifically, an elevated Yield score reflects the impact of misleading or suggestive questioning, which is believed to relate to memory for the event in question, particularly in children (Gudjonsson & Henry, 2003). Shift relates to the extent to which

an individual is willing to change answers due to negative feedback, which is hypothesized to reflect responsiveness to overt social pressure (Gudjonsson, 2003). Gudjonsson and Clark's theoretical model of interrogative suggestibility (1986) posits that the suggestibility process depends on an essential triad of conditions experienced by the interviewee, including uncertainty about the right answer to a question, a belief that the interrogator has honest intentions, and *an expectation perceived by the interviewee to provide a definite answer*. In this study, prior to the negative feedback, children with FASD may not have held the expectation that a *definite* answer is required in response to each question. This view is supported by the finding that children with FASD gave significantly more DK responses than control children, the majority of which were provided during trial 1. Specifically, 84% of the total responses of 'don't know' given by the FASD sample were from the questions that form the Yield score. This was also apparent from the significant negative correlation between Yield and DK responses for the sample of children with FASD. Documented social deficits in individuals with FASD in areas of social communication, social skills and social comprehension (Roebuck, Mattson & Riley, 1999; Streissguth, Bookstein, Barr, Press, & Sampson, 1998; Streissguth et al., 1991; Thomas, Kelly, Mattson & Riley, 1998) may have affected these children's ability to perceive the implicit expectation for a conclusive answer. On the other hand, the control children, theoretically without social impairments, would have inferred that a definite answer was warranted for each question and thus may have been more likely to provide such an answer. Ultimately, the potential lack of perceived expectation to provide a firm answer may have led the FASD sample to provide more DK

responses, which substantially lowered the number of suggestible responses provided during the Yield trial as compared to the control children.

Related to the possibility that children with FASD were not cognizant of the expectation to provide a firm answer, another key difference between Yield and Shift lies in how overt the questioner's attempt is to elicit suggested information. The pull for suggested material through misleading questions may appear more implicit, given that the individual is not made aware of the fact that the questions are purposefully misleading. In contrast, explicit verbal feedback indicating that errors have been made and responses are inaccurate is a more obvious attempt to change one's initial responses from presumably the best or most correct answers to different, and more likely incorrect answers, hence increasing the chance that suggested information is provided in the answer. Again, the social functioning deficits demonstrated by individuals with FASD, including an inability to understand subtle social and communication cues (Roebuck et al., 1999; Streissguth et al., 1991; Streissguth et al., 1998; Thomas et al., 1998), means that the children with FASD may not have perceived the less overt draw for suggested information through misleading questions. In contrast, the children with FASD may have had less difficulty understanding the message that their initial answers were wrong and need to be changed, which led to higher Shift suggestibility scores.

Of interest were the findings revealed from comparison of the current control sample to Miles et al.'s (2007) larger control sample. Notably, all suggestibility scores in the current control sample were significantly higher than those reported for the larger control group, indicating higher suggestibility. The suggestibility scores for the control group in the current study also appear to be substantially higher than GSS2 suggestibility

scores reported for control groups in other studies (for example, Gudjonsson & Henry, 2003; Young et al., 2003). The unexpected finding that the current control group demonstrated consistently higher suggestibility scores than control groups in other studies certainly contributed to the lack of significant group differences on measures of suggestibility in the present study.

Although the explanation for the unusually high suggestibility scores evidenced by the control group is unclear, there are a few possibilities. As mentioned, with regard to the Yield score, the control children may have more strongly perceived the expectation to provide a definite answer to each question. Thus, unlike the FASD sample who provided a high frequency of DK answers, the control group provided conclusive answers, perhaps even by taking guesses or giving the most reasonable or plausible answer. If control children took their best or most reasonable guesses, this would have resulted in the provision of at least some suggestible responses. In support of this hypothesis, when Yield was computed as a fraction representing the number of suggestible responses / the number of misleading questions answered with a definite response, the difference between alcohol exposed ($M = 0.44$, $SD = 0.15$) and typical ($M = 0.55$, $SD = 0.19$) samples was even less significant ($t(19) = 1.33$, $p = 0.200$, $d = -0.33$).

In addition, research has found a relationship between heightened suggestibility and imaginative and creative children (Clarke-Stewart et al., 2004; Melnyk, 2002; Shapiro & Purdy, 2005), as well as a relationship between higher intelligence and creativity (Furnham, Batey, Anand, & Manfield, 2008; Silvia, 2008; Sternberg, 2006). Given that the sample of control children in the present study demonstrated significantly

higher IQs than the children with FASD, it may be the case that some control children were more creative and imaginative, and thus more suggestible.

Response Style

Increased frequency of DK responses to misleading questions have been found in adults with ADHD (Gudjonsson et al., 2007), and this response style serves, at least initially, as a non-suggestive coping strategy (Gudjonsson et al., 2007; Milne, Clare, & Bull, 2002). Post hoc analysis of responses to the questions on the GSS2 revealed that the sample of children with FASD made significantly more DK responses than the control group. The number of DK responses was negatively correlated to Yield scores in the sample of children with FASD, but not in the control sample. Further, when Yield was calculated as a ratio to remove questions that were answered with a DK, the score was even less significantly different between groups. Hence, evidence from this study appears to indicate that the DK response style did in fact lower suggestibility rates for the children with FASD, making them appear less suggestible in comparison to the control group.

Closer examination of the pattern of DK responses for the sample of children with FASD revealed a substantial decrease in the number of DK responses given during the first round of questions (Yield) compared to the second round of questions (Shift), which corresponded to an increase in suggestible responses from Yield to Shift. Specifically, on trial 1 a total of 21 DK responses were given, while on trial 2 only two DK responses were given. This observed decrease in DK responses coincided with an increase in suggestibility, as nine of the 21 questions that were initially answered on trial 1 with a DK response were changed into a suggestible response on trial 2. Thus, after receiving

the negative feedback, the children with FASD evidenced a decrease in reporting not knowing the answer that directly related to an increase in reporting suggested information. Another study reported the same finding, in that adults frequently convert a DK response to a misleading question into a suggestible answer following negative feedback (Scoboria, Mazzoni, Kirsch, & Milling, 2002). Although the control sample provided a total of only four DK responses on trial 1, the same trend was evidenced, in that three of the DK responses were subsequently changed into suggestible responses following negative feedback.

In the present study, the frequency of DK responses did not correlate with either of the GSS2 recall scores, which implies that that the failure to give a definite response is not related to the amount of information remembered. Results from another study also found that GSS Immediate and Delayed recall scores did not correlate with the number of DK responses (Gudjonsson et al., 2007). Hence, other factors may be influencing the way certain individuals choose to answer questions with a DK response, such as heightened memory distrust or uncertainty in response to questions compared to free recall, reluctance to commit to a definite answer, inability to delay responding (Gudjonsson et al., 2007), or, as proposed in the current study, inability to perceive that a definite answer is expected to each question. In summary, although this response style initially appeared to function as a barrier to suggestibility for the children with FASD, following the provision of negative feedback, this response style was no longer employed and a large amount of suggested material was adopted. Extrapolating this finding to general interrogative situations, a DK response style may increase the accuracy of answers to the questions. However, if the provision of a DK response causes the individual to be

viewed as evasive or uncooperative, and thus pressure is applied for a definite response (Gudjonsson et al., 2007), children with FASD may become *more* vulnerable to suggestion as was seen in the present study.

Influence of Social Factors for Individuals with FASD on Suggestibility

Although this study focused exclusively on the relationship between suggestibility and cognitive variables, it is important to note that these constructs do not exist in isolation from the social and environmental context of the child. Individuals with FASD are significantly more likely to be exposed to a variety of external risk factors, including negative life events, that may affect susceptibility to suggestion. In fact, negative social and environmental influences are hypothesized to influence developmental trajectories more so than level of prenatal alcohol exposure (Carta, Atwater, Greenwood, McConnell, McEvoy, & Williams, 2001). Hence, the role of external variables may be of particular relevance to the discussion of suggestibility in individuals with FASD given the tentative finding from the current study that these individuals may display heightened suggestibility in response to social influence (i.e. negative feedback or pressure).

One primary difference between individuals with and without FASD is that prenatal alcohol exposure is associated with experiencing a higher number of and more severe negative life events. The most common adverse life events associated with FASD include living with an alcoholic parent(s), low parental supervision, early maternal death, abuse and neglect, repetitive periods of foster or group care, disrupted schooling (suspended, expelled, dropping out, learning problems), and trouble with the law (Streissguth et al., 2004). For example, in a sample of individuals with FASD aged 12-40 years, each individual had lived in an average of five foster or group homes; in addition,

69% of the biological mothers had died, primarily due to alcohol-related illnesses and alcohol-related causes such as suicide, homicide, and automobile accidents (Streissguth et al., 1991). Further, research suggests that environmental conditions of abuse, neglect, stress, and maternal separation and loss are associated with deficits in prefrontal cortex development (Kaufman & Charney, 2001; Kaufman, Plotsky, Nemeroff, & Charney, 2000; Sánchez, Ladd, & Plotsky, 2001), which may uniquely contribute to higher suggestibility given the correlations between prefrontal tasks and suggestibility (Bruck & Melnyk, 2004).

Foster care is another risk factor more frequently associated with children with prenatal alcohol exposure than non-exposed children. For example, the United States General Accounting Office (1997) estimates that approximately two-thirds of children in care were prenatally exposed to alcohol and/or drugs, and this statistic is likely to be an underestimation due to reliance on maternal self-reports and toxicology tests (which can only confirm *recent* drug or alcohol use). Further, the report identified prenatal substance exposure as a primary factor accounting for the growing number of children entering foster care. Foster care placement is also known to be correlated with an increased involvement with the juvenile criminal justice system (Kood & Kennedy, 2003).

Children who are placed in care due to parental drug/alcohol abuse tend to enter at a younger age, and experience a higher number of placements than children placed in care for other reasons (Fanshel, 1975). In general, foster care has been associated with developmental delays as assessed by measures of physical height and head circumference, as well as substantial neuropsychological delays in areas of intellectual functioning, visuospatial abilities, and language (Pears & Fisher, 2005). In research

studies, placement instability (two or more foster placements) correlated with reduced performance on tasks related to prefrontal cortical circuitry, such as weaker inhibitory control (Lewis, Dozier, Ackerman, & Sepulveda-Kozakowski, 2007) and self-regulation (Pears, Kim, & Fisher, 2008) compared to foster children who experience a single (stable) foster placement. Foster care instability may also contribute to both internalizing and externalizing behavioral issues (Lewis et al., 2007; Newton et al., 2000). Placement instability further predicts hypothalamic-pituitary-adrenal (HPA) axis dysregulation, a system that is activated in response to threatening or stressful events, including unpredictable and uncontrollable events (Fisher, Ryzin, & Gunnar, 2011). Children who experience a foster placement change show smaller cortisol decreases from morning to evening as a result of blunted morning cortisol levels (Fisher & Stoolmiller, 2008; Fisher, Stoolmiller, Gunnar, & Burraston, 2007; Fisher et al., 2011). Lower cortisol levels, may compromise normal brain development in two ways: 1) the initially high cortisol levels may result in abnormally high rates of neuronal cell death; and, 2) the consequential lower cortisol production may fail to meet the basal level of cortisol necessary to promote typical neuronal maturation, replication, differentiation, planned cell death and the creation and organization of synaptic connections (Gunnar & Vazquez, 2001).

In brief, prenatal substance exposure is associated with a higher number of environmental and neurodevelopmental risk factors, some of which are directly related to increased involvement with the foster care system. Importantly, research has shown that experiencing a higher number of and more severe adverse life events is correlated to higher suggestibility (Chae, Goodman, Eisen, & Qin, 2011; Drake, Bull, & Boon, 2010; Drake, 2010; Drake & Bull, 2011) *and* false confession (Gudjonsson, Sigurdsson, &

Sigfusdottir, 2009), indicating that children with FASD may be at risk of suggestion due to the combined effect of cognitive and environmental factors. Moreover, environmental risks associated with prenatal alcohol exposures, including parental substance abuse, low parental supervision, disrupted school experiences, previous trouble with the law, and placement in foster care are well established risk factors predicting subsequent involvement with the criminal justice system (Alltucker, Bullis, Close, & Yovanoff, 2006; Herrenkohl, Maguin, Hill, Hawkins, Abbott, & Catalano, 2000; Jonson-Reid & Barth, 2000; Lynch, Coles, Corley, & Falek, 2003; Saner & Ellickson, 1996).

In addition to the possible contribution of adverse life events to heightened suggestibility in children with FASD, a well established relationship exists between low self-esteem and heightened suggestibility in typically developing children (Baxter, Jackson, & Bain, 2003; Cann & Kant, 2005; Frey & Scoboria, 2012; Howie & Dowd, 1996; Singh & Gudjonsson, 1984; Vrij & Bush, 2000; Zajac, Jury, & O'Neill, 2009), indicating that children with low self-esteem are at a disadvantage within an interrogative situation. Indeed, research has demonstrated that children with prenatal alcohol exposure report lower self-esteem compared to non-exposed children (Rasmussen, Becker, McLennan, Urichuk, & Andrew, 2010; Streissguth, 1997). Moreover, one study found that 80% of children with prenatal alcohol exposure demonstrated insecure attachments to their caregiver (O'Connor, Kogan, & Findlay, 2002), which correlates with lower self-esteem both in childhood and adolescence (McCormick & Kennedy, 1994) and is hypothesized to impact the child's ability to effectively utilize coping strategies and to regulate behaviors and emotions in stressful situations (O'Connor et al., 2002). The noted detrimental impact of low self-esteem on suggestibility in typically developing

children may similarly affect suggestibility in children with FASD. Overall, given the strong associations between suggestibility and environmental factors, many of which are known to correlate with various abnormalities in physical development and neurodevelopment, the impact of social and environmental factors in combination with cognitive factors to suggestibility in children with FASD are important variables to consider in future studies.

Suggestibility in Relation to Question Format

The question formats used in the GSS2 involve only closed selection and closed yes/no questions. From analysis of the frequency of suggestible responses to these two different types of closed questions, children with FASD answered the closed selection questions in a suggestible manner on the Yield and Shift trials more frequently than closed yes/no questions (79% versus 41%), with a similar pattern noted for control children (84% versus 51%). As there were no between group differences in the frequency of suggestible responses to either type of closed question, the scores for each group were combined. Overall, the entire sample answered selection questions in a suggestible manner significantly more often than yes/no questions. Hence, the format of the question appears to affect suggestibility in children. These findings are congruent with other studies that have found misleading selection questions are more likely to elicit a suggestible response compared to misleading yes/no questions (Endres et al., 1999; Gee, Gregory, & Pipe, 1999).

A possible explanation for this finding is that a question providing two specific alternative answers is interpreted as more demanding of an answer because the answer is supposedly supplied by the question, as compared to a question that requires a yes/no

response. Relating this finding to the Gudjonsson and Clarke model of suggestibility (1986), perhaps the children were more receptive to the expectation that an answer is required when the question was in a closed selection format. If this expectation is made, combined with the belief that the interrogator has honest and genuine intentions (Gudjonsson & Clarke, 1986), it may not occur to the child to consider alternative responses. By naming alternatives, the child may infer that other answer choices either do not exist or are not worth considering (May, 1989). Endres et al. (1999) suggest that correctly answering a misleading selection question is more cognitively demanding than a yes/no question, because each alternative must be compared to the original information in order to detect the discrepancy; hence, for children, resisting suggestibility may be more difficult for closed selection questions compared to closed yes/no questions due to higher cognitive resource requirements. Overall, it is important to note that question format had a significant effect on the amount of elicited suggested information for *all* children in the present study, with closed selection questions eliciting a higher frequency of suggested information.

Internalization

A primary issue with Gudjonsson and Clarke's interrogative suggestibility model (1986) is the inability to decipher between compliance, acquiescence, and interrogative suggestibility. Compliance is conceptualized as being comprised of two major components: an eagerness to please others, and a desire to avoid confrontation and conflict with others, especially authority figures (Gudjonsson, 2003). Acquiescence is defined as the tendency to answer questions affirmatively regardless of content (Cronbach, 1946), and is similarly based on a desire to please or willingness to agree with

the interviewer (Finlay & Lyons, 2001). Gudjonsson (1989) postulates that the main difference between interrogative suggestibility and compliance/acquiescence is that the former involves personal acceptance of the suggested information, whereas the latter involve a conscious decision to carry out the behavior as requested, which may not be agreed with privately. However, there is no clear distinction between compliance, acquiescence, and suggestibility because the resulting behavior can be identical (Gudjonsson, 1989; Roper & Shewan, 2002).

With these caveats in mind, the present study employed an adaptation of the GSS2 in an attempt to differentiate internal acceptance of suggested material from compliance and acquiescence. Following the completion of the standard GSS2 protocol, the examiner told the child that he or she had accidentally listened to a different version of the story and therefore to re-answer the questions how he or she *really* thinks the questions should be answered. The internalization score reflects the total number of responses to misleading questions that were answered in a suggestible manner on this third trial. Despite the fact that group differences did not emerge, analyses indicated that all children continued to endorse a high number of suggestible responses. Specifically, on average, each child continued to answer nine of the fifteen misleading questions in a suggestible manner (range: 3-15). Hence, to some degree all children came to believe that suggested information was part of the original GSS2 story, implying that it is relatively easy for children to accept and internalize suggested material.

Given the significant difference between the frequencies of suggestible responses to selection versus yes/no questions, internalization was investigated in the same manner. To the author's knowledge, the internalization of suggested material in relation to

question type has not been investigated. Indeed, results indicate that suggested material posed through a selection question was internalized significantly more often than suggested material posed through a yes/no question, which parallels the finding that selection questions elicit significantly more suggestible responses than yes/no questions. Further, there was no significant difference between the number of suggestible responses given to selection questions and the internalization of material from selection questions, or between the number of suggestible responses provided for yes/no questions and the internalization of material posed through yes/no questions. One possible interpretation of this finding is that the majority of suggested material elicited through questioning came to be believed by the child.

Whether an individual believes that the suggested details he or she reports are from the original source is essentially a question about the ability to identify the memory source. Ackil and Zaragoza (1995) found that the internalization of suggested material in children is due to source misattribution errors, as reflected by answers on a source monitoring test given after a suggestibility measure. In contrast, a recent study used the GSS2 followed by a source identification questionnaire on which participants were asked to identify whether information was from the story or the questions (Mastroberardino & Marucci, 2012). Compliance errors (when individuals gave in to leading questions or shifted answers but attributed the information to the correct source) accounted for the majority of Yield and Shift suggestibility scores as compared to source identification errors (erroneously attributed information to the story). Despite this finding, results from the present study, on which each child was explicitly told to answer the questions how he or she *really* thinks the questions should be answered, tentatively support the notion that

children internalized some of the suggested information, and believed it was part of the original GSS2 story. However, it is still possible that suggestible answers on the internalization trial were provided due to compliancy; a source memory test that specifically asked whether each question was answerable based on the original story may have revealed different findings.

Interestingly, the type of suggestion may also affect children's internalization of suggested information. One study found that children demonstrate higher suggestibility during the suggestive interview for commission (suggestions that details *were* present when in fact they were not) and omission (suggestions that details *were not* present when in fact they were) suggestions, but children were more likely to attribute suggested changes (suggestions that details that were present were presented differently) to the original material, indicating higher internalization for changed details rather than omitted or committed details (Candel, Hayne, Strange & Prevoo, 2009). These results are consistent with the predictions of the discrepancy detection principle (Loftus, 1992): the greater the overlap between experienced and suggested information, and the subtler the manipulation, the higher the chance that suggested information will be accepted. Given that the GSS2 employs only commission suggestions, internalization rates may in fact be underestimated, and the inclusion of questions that assess a variety of suggestion types may reveal even higher rates of internalization.

Recommendations for Police Interviews

Based on results from the present study, children with FASD may be more likely to endorse suggestible material following negative feedback. In addition, all children appear particularly vulnerable to answering misleading questions in a suggestible manner

when the question is posed in a closed selection question format, and this relates to higher internalization rates of suggested information posed through selection questions. Hence, interrogation procedures should adopt interview strategies that aim to minimize any negative feedback or pressure, and take particular care to avoid selection questions in order to foster accurate recall.

In general, there is a dearth of empirical data on interrogative practices and techniques used with children in Canada. Surveys completed by law enforcement officers reveal that although developmental differences between youth and adults are acknowledged, the dominant view is that youth can be treated in the same manner as adults during interrogative situations (Meyer & Reppucci, 2007). Reports indicate that Canadian police officers receive minimal interview training and they are trained to apply the same interviewing skills used with adults to interrogations with youth (Redlich, Silverman, Chen, & Steiner, 2004; Snook, Eastwood, Stinson, Tedeschini, & House, 2010). One concerning interrogation outcome is false confession, particularly in light of research indicating younger individuals are disproportionately more likely to falsely confess (Drizin & Leo, 2004; Kassin, Appleby, & Perillo, 2010; Redlich & Goodman, 2003), and confession is the most influential form of evidence shaping jurors' decisions of guilt (Drizin & Leo, 2004; Kassin & Neumann, 1997).

In one of the few North American studies that examined police interrogation techniques, Leo (1996) directly observed and analyzed 182 interviews. The most common tactics included: appealing to the suspect's self-interest by suggesting that the suspect will benefit if he or she confesses (88%), confronting the suspect with true (85%) or false evidence (30%), undermining the suspect's confidence in denial of guilt (43%),

appealing to the importance of cooperation (37%), and appealing to the detective's expertise/authority (29%). Clearly, many of these strategies use negative pressure to coerce individuals into providing the desired (and potentially suggested) response. Again, this may have especially detrimental effects on the accuracy of elicited information if such techniques are employed with children with FASD.

Content analysis of Canadian police interview questions indicate that only 0.16 questions per minute are open questions, while 0.28 questions per minute are misleading, 1.22 are closed yes/no questions and 0.16 are closed selection questions (Wright & Alison, 2004). Other examinations of interviewing practices in Canada indicate a similar overreliance on closed-ended questions in comparison to open-ended questions (Snook, & Keating, 2011). Research is clear that the use of certain tactics, such as repeated, misleading, and closed questioning, lead to the elicitation of inaccurate information in children with and without intellectual disability, compared to free recall and open-ended questions (Endres et al., 1999; Gee, Gregory, & Pipe, 1999; Greenstock & Pipe, 1996; Hershkowitz, Lamb, Sternberg, & Esplin, 1997; Kebbell, Hatton, & Johnson, 2004; Perlman, Ericson, Esses, & Isaacs, 1994). Kassin and colleagues suggest that law enforcement personnel who conduct interviews and interrogations with vulnerable populations should receive specialized training on how to structure the process of interrogation to produce accurate outcomes (Kassin, Drizin, Grisso, Gudjonsson, Leo, & Redlich, 2010). Specifically, interrogation training should focus on teaching an array of alternative techniques to increase children's ability to coherently and accurately recount an event.

Studies have developed and empirically tested interventions that successfully reduce suggestibility by increasing children's awareness of: 1) task demands (misleading questions, adult expectations and intentions); 2) appropriate responses options (including 'I don't know'); and, 3) negative consequences of acquiescence, and by permitting practice interview questions for which correct responses are reinforced and encouraged (Gee et al., 1999; Saywitz & Moan-Hardie, 1994). Indeed, as demonstrated by the present study and by other studies, a 'don't know' response is appropriate if the answer to a question is unknown because this response style can protect against suggestibility (Memon, Holley, Wark, Bull, & Köhnken, 1996; Gudjonsson et al., 2007). In support of this, studies have found that children and adults are more resistant to suggestion when specifically warned that the questions would be difficult or tricky and that answers should only reflect what is really remembered (Warren, Hulse-Trotter, & Tubbs, 1991). Hence, appropriate interrogative techniques for children, validated through experimental research, need to be put into practice, to minimize vulnerability to suggestion and false confession

Limitations and Future Direction

Caution must be taken when interpreting and generalizing the current results, since sample sizes were small and represent only a portion of alcohol exposed and typical populations. Further, interpretations derived from comparisons between the current clinical and control groups to the larger control sample from a recently published study (Miles et al., 2007) may be limited due to differences in GSS2 administration. The current study employed a 40-50 minute delay between the GSS2 Immediate recall and Delayed recall, after which the participants answered the Yield and Shift questions; in the

comparison study, the 40-50 minute delay was eliminated and the GSS2 Immediate recall was directly followed by Yield and Shift. It is possible that the delay period in some way led to increased suggestibility scores, perhaps due to poorer recall for the information in the story. One study found that GSS2 Immediate recall scores (group 1) were consistent with GSS2 Delayed recall scores (group 2), which was interpreted as indicating that differences in memory for story details were unlikely to affect suggestibility scores (Pollard, Trowbridge, Slade, Streissguth, Laktonen, & Townes, 2004). In the present study, there was no difference between Immediate and Delayed recall scores in the sample of children with FASD; however, scores in the control group did drop significantly over time (i.e., approximately 1.8 fewer details were recalled after a delay). Hence, the procedural differences should not affect interrogative suggestibility scores for the FASD group, but it is unclear how the delay affected suggestibility scores for the control sample.

Another important consideration is the extent to which the GSS2 simulates an interrogative situation. There are unique differences between being read a narrative passage, recalling the passage, and answering questions about the passage, versus personally experiencing an event, recalling the event, and answering questions about the event. Experiencing an event involves multiple sensory inputs, the primary input being visual, whereas the GSS scales, and other suggestibility measures, frequently rely on a verbal only presentation. It is argued that input from multiple modalities is likely to result in more elaborate memory traces than input from a single modality (Kosslyn & Koenig, 1992), which would serve to increase recall and potentially decrease suggestibility. In support of this view, Cardone and Dent (1990) presented the GSS2 oral

narrative passage to half of the participants, while the other half listened to the narrative passage while viewing 17 pictures that depicted scenes of the story. The combined visual-verbal presentation led to a more complete and accurate recall as well as lower Yield scores than the verbal only presentation. Another issue with the GSS scales is that the questions pertain to peripheral, minute details rather than primary events (Goodman, Rudy, Bottoms, & Aman, 1990). Asking an individual questions that contain misleading information for irrelevant details may not relate in any meaningful way to understanding if or why an individual is more or less suggestible during an interrogation.

One final issue with the GSS measures is based on the argument that there is an important distinction between answering misleading questions about personally significant actions (autobiographical memory) versus a story. In particular, 'action memory' is different from laboratory measures of memory in three unique ways: 1) action memory involves a situation in which an individual is actively engaged; 2) action memory is formed unintentionally; and, 3) action memory includes a series of reciprocal actions and reactions with the environment (Zimmer, & Cohen, 2001). White and Wallner (2005) examined the relationship between autobiographical memory and suggestibility by creating two sets of parallel narratives and misleading questions about events the individuals had actually experienced, and comparing these scores to GSS suggestibility scores. Although there were no differences between the three measures (yield, shift, total suggestibility) in the control group who did not experience the events, all suggestibility scores were lower on the parallel forms compared to the GSS for the individuals who had experienced the events. All of these critiques suggest that the GSS2, and similar suggestibility measures, may in fact overestimate how suggestible an

individual would be in a true forensic context. Hence, a more ecologically valid assessment of interrogative suggestibility that involves a real-life memory situation may have different findings than those revealed in the present study.

Research on suggestibility has primarily focused on differences between individuals, which does little to inform best practice procedures for conducting investigate interviews with children. Undeniably, police need to have persuasive strategies and questioning techniques to make uncooperative children and youth cooperative. Future research should begin to address alternative interview tactics, applicable specifically to children, that maximize the amount of accurate information recalled and reduces the amount of suggested or inaccurate information recalled and the rate of false confessions.

Conclusions

Interrogative suggestibility is an important psychological construct that is relevant to understanding how children cope with leading questions and psychological pressure when being questioned by a person of authority, whether it is a police officer, teacher, or other adult. To date, research has not examined interrogative suggestibility in children with FASD, despite the fact that these populations have been clinically and anecdotally described as vulnerable to manipulation. Preliminary results from this study tentatively posit that children with FASD may display higher suggestibility in response to negative pressure, similar to results obtained from assessment of suggestibility in adults with FASD (Brown et al., 2011). Since youth with FASD are disproportionately represented in the juvenile justice system (Streissguth et al., 2004), law enforcement officers, or any individual who is questioning a child with FASD about an event, should take preventative

measures to minimize or eliminate any pressure or negative feedback, to ensure that information is gathered in a way that is fair and accurate. In addition, results from this study indicate that suggested information is elicited more frequently from children in response to closed selection questions compared to closed yes/no questions. The same pattern is evidenced with regards to internalizing suggested material, as children tended to believe that suggested information posed through selection questions was from the original event more often than suggested information derived from yes/no questions. Hence, it is prudent that question format within an interrogative setting is designed in such a way that minimizes the risk of eliciting inaccurate information.

Bibliography

- Abel, E. L. (1980). Fetal alcohol syndrome: Behavioral teratology. *Psychological Bulletin*, *87*, 29-50.
- Abel, E. L. (1981). Behavioral teratology of alcohol. *Psychological Bulletin*, *90*, 564-581.
- Ackil, J. K., & Zaragoza, M. S. (1995). Developmental differences in eyewitness suggestibility and source for memory. *Journal of Experimental Child Psychology*, *60*, 57-83.
- Alexander, K. W., Goodman, G. S., Schaaf, J. M., Edelstein, R. S., Quas, J. A., & Shaver, P. R. (2002). The role of attachment and cognitive inhibition in children's memory and suggestibility for a stressful event. *Journal of Experimental Child Psychology*, *83*, 262-290.
- Alltucker, K. W., Bullis, M., Close, D., & Yovanoff, P. (2006). Characteristics of early and late starters in a sample of previously incarcerated youth. *Journal of Child and Family Studies*, *15*, 479-492.
- Archibald, S. L., Fennema-Notestine, C., Gamst, A., Riley, E. P., Mattson, S. N., & Jernigan, T. L. (2001). Brain dysmorphology in individuals with severe prenatal alcohol exposure. *Developmental Medicine and Child Neurology*, *43*, 148-154.
- Astley, S. J., Aylward, E. H., Olson, H. C., Kerns, K., Brooks, A., Coggins, T. E., Davies, J., Dorn, S., Gendler, B., Jirikowic, T., Kraegel, P., Maravilla, K., & Richards, T. (2009a). Functional magnetic resonance imaging outcomes from a comprehensive magnetic resonance study of children with fetal alcohol spectrum disorders. *Journal of Neurodevelopmental Disorders*, *1*, 61-80.
- Astley, S. J., Aylward, E. H., Olson, H. C., Kerns, K., Brooks, A., Coggins, T. E., Davies, J., Dorn, S., Gendler, B., Jirikowic, T., Kraegel, P., Maravilla, K., & Richards, T. (2009b). Magnetic resonance imaging outcomes from a comprehensive magnetic resonance study of children with fetal alcohol spectrum disorders. *Alcoholism: Clinical and Experimental Research*, *33*, 1671-1689.
- Astley, S. J., Magnuson, S. I., Omnell, L. M., & Clarren, S. K. (1999). Fetal alcohol syndrome: Changes in craniofacial form with age, cognition, and timing of ethanol exposure in the Macaque. *Teratology*, *59*, 163-172.
- Astley, S. J., Richards, T., Aylward, E. H., Olson, H. C., Kerns, K., Brooks, A., Coggins, T. E., Davies, J., Dorn, S., Gendler, B., Jirikowic, T., Kraegel, P., & Maravilla, K. (2009c). Magnetic resonance spectroscopy outcomes from a comprehensive

magnetic resonance study of children with fetal alcohol spectrum disorders. *Magnetic Resonance Imaging*, 27, 760-778

- Baxter, J.S., Jackson, M., & Bain, S.A. (2003). Interrogative suggestibility: Interaction between interviewees' self-esteem and interviewer style. *Personality and Individual Differences*, 35, 1285-1292.
- Bezeau, S., & Graves, R. (2001). Statistical power and effect sizes of clinical neuropsychology research. *Journal of Clinical and Experimental Neuropsychology*, 23, 399-406.
- Bookstein, F. L., Sampson, P.D., Connor, P. D., & Streissguth, A. P. (2002). Midline corpus callosum is a neuroanatomical focus of fetal alcohol damage. *The Anatomical Record*, 269, 162-174.
- Bookstein, F. L., Sampson, P.D., Streissguth, A. P., & Connor, P. D. (2001). Geometric morphometrics of corpus callosum and subcortical structures in the fetal-alcohol-affected brain. *Teratology*, 64, 4-32.
- Bookstein, F. L., Streissguth, A. P., Sampson, P. D., Connor, P. D., & Barr, H. M. (2002). Corpus callosum shape and neuropsychological deficits in adult males with heavy fetal alcohol exposure. *NeuroImage*, 15, 233-251.
- Brown, N. N., Gudjonsson, G., & Connor, P. (2011). Suggestibility and Fetal Alcohol Spectrum Disorders: I'll tell you anything you want to hear. *Journal of Psychiatry and Law*, 39, 30-71.
- Bruck, M., & Ceci, S. J. (1997). The suggestibility of young children. *Current Directions in Psychological Science*, 6, 75-79.
- Bruck, M., & Ceci, S. J. (1999). The suggestibility of children's memory. *Annual Review of Psychology*, 50, 419-439.
- Bruck, M., & Melnyk, L. (2004). Individual differences in children's suggestibility: A review and synthesis. *Applied Cognitive Psychology*, 18, 947-996.
- Calicchia, J. A., & Santostefano, S. (2004). The assessment of interrogative suggestibility in adolescents: Modalities, gender, and cognitive control. *North American Journal of Psychology*, 6, 1-12.
- Candel, I., Hayne, H., Strange, D., & Prevoo, E. (2009). The effect of suggestion on children's recognition memory for seen and unseen details. *Psychology, Crime and Law*, 15, 29-39.

- Cann, D.R., & Katz, A.N. (2005). Habitual acceptance of misinformation: Examination of individual differences and source attributions. *Memory and Cognition*, *33*, 405-417.
- Cardone, D., & Dent, H. Memory and interrogative suggestibility: The effects of modality of information presentation and retrieval conditions upon the suggestibility scores of people with learning disabilities. *Legal and Criminological Psychology*, *1*, 165-177.
- Carta, J.J., Atwater, J.B., Greenwood, C.R., McConnell, S.R., McEvoy, M.A., & Williams, R. (2001). Effects of cumulative prenatal substance exposure and environmental risks on children's developmental trajectories. *Journal of Clinical Child Psychology*, *30*, 327-337.
- Chae, Y., Goodman, G.S., Eisen, M.L., & Qin, J. (2011). Event memory and suggestibility in abused and neglected children: Trauma-related psychopathology and cognitive functioning. *Journal of Experimental Child Psychology*, *110*, 520-538.
- Chudley, A. E., Conry, J., Cook, J. L., Looock, C., Rosales, T., & LeBlanc, N. (2005). Fetal alcohol spectrum disorder: Canadian guidelines for diagnosis. *Canadian Medical Association Journal*, *172* (5 suppl), S1-S21.
- Clare, I. C. H., Gudjonsson, G. H., Rutter, S. C., & Cross, P. (1994). The inter-rater reliability of the Gudjonsson Suggestibility Scale (Form 2). *British Journal of Clinical Psychology*, *33*, 357-365.
- Clark, E., Lutke, J., Minnes, P., & Ouellette-Kuntz, H. (2004). Secondary disabilities among adults with fetal alcohol spectrum disorder in British Columbia. *Journal of FAS International*, *2*, 1-12.
- Clarke-Stewart, K. A., Malloy, L. C., & Allhusen, V. D. (2004). Verbal ability, self-control, and close relationships with parents protect children against misleading suggestions. *Applied Cognitive Psychology*, *18*, 1037-1058.
- Coffin, T. E. (1941). Some conditions of suggestion and suggestibility: A study of certain attitudinal and situational factors influencing the process of suggestion. *Psychological Monographs*, *53*, 1-121.
- Cohen J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. 2nd edition. New Jersey, USA: Lawrence Erlbaum Associates.
- Coles, C. D., Platzman, K. A., Raskind-Hood, C. L., Brown, R. T., Falek, A., & Smith, I. E. (1997). A comparison of children affected by prenatal alcohol exposure and attention deficit, hyperactivity disorder. *Alcoholism: Clinical and Experimental Research*, *21*, 150-161.

- Conway, A. R. A., Kane, M. J., & Engle, R. W. (2003). Working memory capacity and its relation to general intelligence. *Trends in Cognitive Sciences, 7*, 547-552.
- Coxon, P., & Valentine, T. (1997). The effects of age of eyewitnesses on the accuracy and suggestibility of their testimony. *Applied Cognitive Psychology, 11*, 415-430.
- Cronbach, L. J. (1946). Response sets and test validity. *Educational and Psychological Measurement, 6*, 475-494.
- Davis, S.L., & Bottoms, B.L. (2002). Effects of social support on children's eyewitness reports: A test of the underlying mechanism. *Law and Human Behavior, 26*, 185-215.
- Danielsdottir, G., Sigurgeirsdottir, S., Einardsdottir, H. R., & Haraldsson, E. (1993). Interrogative suggestibility in children and its relationship with memory and vocabulary. *Personality and Individual Differences, 14*, 499-502.
- Dempster, F. N. (1993). Resistance to interference: Developmental changes in a basic processing mechanism. In M. L. Howe & R. Pasnak (Eds.), *Emerging themes in cognitive development: Vol. 1. Foundations* (pp. 3-27). New York: Springer-Verlag.
- Desgranges, B., Baron, J-C., & Eustache, F. (1998). The functional neuroanatomy of episodic memory: The role of the frontal lobes, the hippocampal formation, and other areas. *NeuroImage, 8*, 193-213.
- Desmond, J. E., Gabrieli, J. D. E., Wagner, A. D., Ginier, B. L., & Glover, G. H. (1997). Lobular patterns of cerebellar activation in verbal working-memory and finger-tapping tasks as revealed by functional MRI. *The Journal of Neuroscience, 17*, 9675-9685.
- Drake, K.E. (2010). Interrogative suggestibility: Life adversity, neuroticism, and compliance. *Personality and Individual Differences, 48*, 493-498.
- Drake, K.E., & Bull, R. (2011). Individual differences in interrogative suggestibility: Life adversity and field dependence. *Psychology, Crime & Law, 17*, 677-687.
- Drake, K.E., Bull, R., & Boon, J.C.W. (2008). Interrogative suggestibility, self-esteem, and the influence of negative life-events. *Legal and Criminological Psychology, 13*, 299-307.
- Drizin, S. A., & Leo, R. A. (2004). The problem of confessions in the post-DNA world. *North Carolina Law Review, 82*, 891-1007.

- Eisen, M. L., Qin, J., Goodman, G. S., & Davis, S. L. (2002). Memory and suggestibility in maltreated children: Age, stress arousal, dissociation, and psychopathology. *Journal of Experimental Child Psychology, 83*, 167-212.
- Endres, J., Poggenpohl, C., & Erben, C. (1999). Repetitions, warnings and videos: Cognitive and motivational components in preschool children's suggestibility. *Legal and Criminological Psychology, 4*, 129-146.
- Eysenck, H. J. (1943). Suggestibility and hypnosis – An experimental analysis. *Proceedings of the Royal Society of Medicine, 36*, 349-354.
- Eysenck, H. J. & Furneaux, W. D. (1945). Primary and secondary suggestibility: An experimental and statistical study. *Journal of Experimental Psychology, 35*, 485-503.
- Fanshel, D. (1975). Parental failure and consequences for children: The drug-abusing mother whose children are in foster care. *American Journal of Public Health, 65*, 604-612.
- Fast, D. K., & Conry, J. (2004). The challenge of fetal alcohol spectrum disorder in the criminal legal system. *Addiction Biology, 9*, 161-166.
- Fast, D. K. & Conry, J. (2009). Fetal alcohol spectrum disorders and the criminal justice system. *Developmental Disabilities Research Reviews, 15*, 250-257.
- Fast, D. K., Conry, J., & Loock, C. A. (1999). Brief reports: Identifying fetal alcohol syndrome among youth in the criminal justice system. *Developmental and Behavioral Pediatrics, 20*, 370-372.
- Finlay, W. M. L., & Lyons, E. (2001). Methodological issues in interviewing and using self-report questionnaires with people with mental retardation. *Psychological Assessment, 13*, 319-335.
- Fisher, P.A., Van Ryzin, M.J., & Gunnar, M.R. (2011). Mitigating HPA axis dysregulation associated with placement changes in foster care. *Psychoneuroendocrinology, 36*, 531-539.
- Fisher, P.A., & Stoolmiller, M. (2008). Intervention effects on foster parent stress: Associations with child cortisol levels. *Developmental and Psychopathology, 20*, 1003-1021.
- Fisher, P.A., Stoolmiller, M., Gunnar, M.R., & Burraston, B.O. (2007). Effects of a therapeutic intervention for foster preschoolers on diurnal cortisol activity. *Psychoneuroendocrinology, 32*, 892-905.

- Fletcher, P. C., Shallice, T., Frith, C. D., Frackowiak, R. S. J., & Dolan, R. J. (1998). The functional roles of prefrontal cortex in episodic memory. II. Retrieval. *Brain*, *121*, 1249-1256.
- Frey, M.C., & Scoboria, A. (2012). Self-esteem predicts quality of responding to interview questions when skill in responding is low. *Personality and Individual Differences*, *52*, 363-368.
- Fryer, S. L., Tapert, S. F., Mattson, S. N., Paulus, M. P., Spadoni, A. D., & Riley, E. P. (2007). Prenatal alcohol exposure affects frontal-striatal BOLD response during inhibitory control. *Alcoholism: Clinical and Experimental Research*, *31*, 1-10.
- Furnham, A., Batey, M., Anand, K., & Manfield, J. (2008). Personality, hypomania, intelligence and creativity. *Personality and Individual Differences*, *44*, 1060-1069.
- Geddie, L., Fradin, S., & Beer, J. (2000). Child characteristics which impact accuracy of recall and suggestibility in preschoolers: Is age the best predictor? *Child Abuse and Neglect*, *24*, 223-235.
- Gee, S., Gregory, M., & Pipe, M-E., (1999). 'What colour is your pet dinosaur?' The impact of pre-interview training and question type of children's answers. *Legal and Criminological Psychology*, *4*, 111-128.
- Gerstadt, C. L., Hong, Y. J., & Diamond, A. (1994). The relationship between cognition and action: Performance of children 3.5-7 years old on a Stroop-like day-night task. *Cognition*, *53*, 129-153.
- Goodman, G. S., Rudy, L., Bottoms, B. L., & Aman, C. (1990). Children's concerns and memory: Issues of ecological validity in the study of children's eyewitness testimony. In R. Fivush & J. A. Hudson (Eds.), *Knowing and remembering in young children* (pp. 249-284). New York, N.Y.: Cambridge University Press.
- Greenstock, J., & Pipe, M-E. (1996). Interviewing children about past events: The influence of peer support and misleading questions. *Child Abuse and Neglect*, *20*, 1996.
- Gruppuso, V. (2009, March). *Interrogative suggestibility in children with FASD: Preliminary findings*. Poster presented at the 3rd International Conference on Fetal Alcohol Spectrum Disorder, Victoria, BC, Canada.
- Gudjonsson, G. H. (1984). A new scale of interrogative suggestibility. *Personality and Individual Differences*, *5*, 303-314.
- Gudjonsson, G. H. (1987a). A parallel form of the Gudjonsson Suggestibility Scale. *British Journal of Clinical Psychology*, *26*, 215-221.

- Gudjonsson, G. H. (1987b). Historical background to suggestibility: How interrogative suggestibility differs from other types of suggestibility. *Personality and Individual Differences, 8*, 347-355.
- Gudjonsson, G. H. (1989). Compliance in an interrogation situation: A new scale. *Personality and Individual Differences, 10*, 535-540.
- Gudjonsson, G. H. (2003). *The psychology of interrogations and confessions: A handbook*. England: John Wiley & Sons, Ltd.
- Gudjonsson, G. H., & Clark, N. K. (1986). Suggestibility in police interrogation: A social psychological model. *Social Behavior, 1*, 83-104.
- Gudjonsson, G. H., & Henry, L. A. (2003). Child and adult witnesses with intellectual disabilities: The importance of suggestibility. *Legal and Criminological Psychology, 8*, 241-252.
- Gudjonsson, G., Sigurdsson, J.F., & Sigfusdottir, I.D. (2009). False confession among 15- and 16-year-olds in compulsory education and the relationship with adverse life events. *The Journal of Forensic Psychiatry and Psychology, 20*, 950-963.
- Gudjonsson, G. H., Young, S., & Bramham, J. (2007). Interrogative suggestibility in adults diagnosed with attention-deficit hyperactivity disorder (ADHD). A potential vulnerability during police questioning. *Personality and Individual Differences, 43*, 737-745.
- Gunnar, M.R., & Vazquez, D.M. (2001). Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development. *Development and Psychopathology, 13*, 515-538.
- Harnishfeger, K. K., & Bjorklund, D. F. (1994). A developmental perspective on individual differences in inhibition. *Learning and Individual Differences, 6*, 331-355.
- Health Canada, (2006). *Fetal alcohol spectrum disorder: It's your health*. Retrieved April 20, 2010, from <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/diseases-maladies/fasd-etcaf-eng.php#is>.
- Henry, L. A., & Gudjonsson, G. H. (1999). Eyewitness memory and suggestibility in children with mental retardation. *American Journal on Mental Retardation, 104*, 491-508.
- Henry, L. A. & Gudjonsson, G. H. (2003). Eyewitness memory, suggestibility, and repeated recall sessions in children with mild and moderate intellectual disabilities. *Law and Human Behavior, 27*, 481-505.

- Henry, L. A. & Gudjonsson, G. H. (2004). The effects of memory trace strength on eyewitness recall in children with and without intellectual disabilities. *Journal of Experimental Child Psychology, 89*, 53-71.
- Henry, L. A. & Gudjonsson, G. H. (2007). Individual and developmental differences in eyewitness recall and suggestibility in children with intellectual disabilities. *Applied Cognitive Psychology, 21*, 361-381.
- Herrenkohl, T.I., Maguin, E., Hill, K.G., Hawkins, J.D., Abbott, R.D., & Catalano, R.F. (2000). Developmental risk factors for youth violence. *Journal of Adolescent Health, 26*, 176-186.
- Hershkowitz, I., Lamb, M. E., Sternberg, K. J., & Esplin, P. W. (1997). The relationship among interviewer utterance type, CBCA scores and the richness of children's responses. *Legal and Criminological Psychology, 2*, 169-176.
- Howie, P.M., & Dowd, H.J. (1996). Self-esteem and the perceived obligation to respond: Effects on children's testimony. *Legal and Criminological Psychology, 1*, 197-209.
- IBM SPSS Statistics (Version 19.0.0) [software]. (2010). Somers, N.Y.: SPSS Inc. an IBM company.
- Jacobson, J. L., & Jacobson, S. W. (1994). Prenatal alcohol exposure and neurobehavioral development. *Alcohol Health & Research World, 18*, 30-36.
- Jones, K. L., & Smith, D. W. (1973). Recognition of the fetal alcohol syndrome in early infancy. *The Lancet, 2*, 999-1001.
- Jonson-Reid, M., & Barth, M.P. (2000). From placement to prison: The path to adolescent incarceration from child welfare supervised foster or group care. *Children and Youth Services Review, 22*, 493-516.
- Karpinski, A. C., & Scullin, M. H. (2009). Suggestibility under pressure: Theory of mind, executive function, and suggestibility in preschoolers. *Journal of Applied Developmental Psychology, 30*, 749-763.
- Kassin, S. M., & Neumann, K. (1997). On the power of confession evidence: An experimental test of the fundamental difference hypothesis. *Law and Human Behavior, 21*, 469-484.
- Kassin, S. M., Appleby, S. C., & Perillo, J. T. (2010). Interviewing suspects: Practice, science, and future directions. *Legal and Criminological Psychology, 15*, 39-55.

- Kassin, S. M., Drizin, S. A., Grisso, T., Gudjonsson, G. H., Leo, R. A., & Redlich, A. D. (2010). Police-induced confessions: Risk factors and recommendations. *Law and Human Behavior, 34*, 3-38.
- Kaufman, J., & Charney, D. (2001). Effects of early stress on brain structure and function: Implications for understanding the relationship between child maltreatment and depression. *Development and Psychopathology, 13*, 451-471.
- Kaufman, J., Plotsky, P.M., Nemeroff, C.B., & Charney, D.S. (2000). Effects of early adverse experiences on brain structure and function: Clinical implications. (2000). *Biological Psychiatry, 48*, 778-790.
- Kebbell, M. R., Hatton, C., & Johnson, S. D. (2004). Witnesses with intellectual disabilities in court: What questions are asked and what influence do they have? *Legal and Criminological Psychology, 9*, 23-35.
- Kodituwakku, P. W., Handmaker, N. S., Cutler, S. K., Weathersby, E. K., & Handmaker, S. D. (1995). Specific impairments in self-regulation in children exposed to alcohol prenatally. *Alcoholism: Clinical and Experimental Research, 19*, 1558-1564.
- Kodituwakku, P. W., Kalberg, W., & May, P. A. (2001a). The effects of prenatal alcohol exposure on executive functioning. *Alcohol Research and Health, 25*, 192-198.
- Kodituwakku, P. W., May, P. A., Clericuzio, C. L., & Weers, D. (2001b). Emotion-related learning in individuals prenatally exposed to alcohol: An investigation of the relation between set shifting, extinction of responses and behavior. *Neuropsychologia, 39*, 699-708.
- Kood, S., & Kennedy, C. (2003). Foster child health and development: Implications for primary care. *Pediatric Nursing, 29*, 39-46.
- Kosslyn, S. M., & Koenig, O. (1992). *Wet Mind The New Cognitive Neuroscience*. New York: Free Press.
- Lee, K. (2004). Age, neuropsychological, and social cognitive measures as predictors of individual differences in susceptibility to the misinformation effect. *Applied Cognitive Psychology, 18*, 997-1019.
- Lehman, E. B., McKinley, M. J., Thompson, D. W., Leonard, A. M., Liebman, J. I., & Rothrock, D. D. (2010). Long-term stability of young children's eyewitness accuracy, suggestibility, and resistance to misinformation. *Journal of Applied Developmental Psychology, 31*, 145-154.
- Leo, R. A. (1996). Inside the interrogation room. *The Journal of Criminal Law and Criminology, 86*, 266-303.

- Lewis, E.E., Dozier, M., Ackerman, J., & Sepulveda-Kozakowski, S. (2007). The effect of placement instability on adopted children's inhibitory control abilities and oppositional behavior. *Developmental Psychology, 43*, 1415-1427.
- Loftus, E. F. (1992). When a lie becomes memory's truth: Memory distortion after exposure to misinformation. *Current Directions in Psychological Science, 1*, 121-123.
- Lynch, M.E., Coles, C.D., Corley, T., & Falek, A. (2003). Examining delinquency in adolescents differentially prenatally exposed to alcohol: The role of proximal and distal risk factors. *Journal of Studies on Alcohol and Drugs, 64*, 678-686.
- Malisza, K. L., Allman, A-A., Shiloff, D., Jakobson, L., Longstaffe, S., & Chudley, A. E. (2005). Evaluation of spatial working memory function in children and adults with fetal alcohol spectrum disorders: A functional magnetic resonance imaging study. *Pediatric Research, 58*, 1150-1157.
- Manly, T., Robertson, I. H., Anderson, V., & Nimmo-Smith, I. (1999). *The Test of Everyday Attention for Children (TEA-Ch)*. Bury St Edmunds, UK: Thames Valley Test Company.
- Marche, T. A. (1999). Memory strength affects reporting of misinformation. *Journal of Experimental Child Psychology, 73*, 45-71.
- Mastroberardino, S., & Marucci, F. S. (2012). Interrogative suggestibility: Was it just compliance or a genuine false memory? *Legal and Criminological Psychology*. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/j.2044-8333.2012.02048.x/pdf>.
- Mattson, S. N., & Riley, E. P. (1998). A review of the neurobehavioral deficits in children with fetal alcohol syndrome or prenatal exposure to alcohol. *Alcoholism: Clinical and Experimental Research, 22*, 279-294.
- Mattson, S. N., & Riley, E. P. (1999). Implicit and explicit memory functioning in children with heavy prenatal alcohol exposure. *Journal of the International Neuropsychological Society, 5*, 462-471.
- Mattson, S. N., Goodman, A. M., Caine, C., Delis, D. C., & Riley, E. P. (1999). Executive functioning in children with heavy prenatal alcohol exposure. *Alcoholism: Clinical and Experimental Research, 23*, 1808-1815.
- Mattson, S. N., Riley, E. P., Archibald, S. A., & Jernigan, T. L. (2001). Caudate volume predicts CVLT-C and WCST performance of children with heavy prenatal alcohol exposure. *Alcoholism: Clinical and Experimental Research, 25 (Suppl. 5)*, 74A.

- Mattson, S. N., Riley, E. P., Delis, D. C., Stern, C., & Jones, K. L. (1996). Verbal learning and memory in children with fetal alcohol syndrome. *Alcoholism: Clinical and Experimental Research, 20*, 810-816.
- Mattson, S. N., Riley, E. P., Gramling, L., Delis, D. C., & Jones, K. L. (1997). Heavy prenatal alcohol exposure with or without physical features of fetal alcohol syndrome leads to IQ deficits. *The Journal of Pediatrics, 131*, 718-721.
- Mattson, S. N., Riley, E. P., Sowell, E. R., Jernigan, T. L., Sobel, D. F., & Jones, K. L. (1996). A decrease in the size of the basal ganglia in children with fetal alcohol syndrome. *Alcoholism: Clinical and Experimental Research, 20*, 1088-1093.
- Mattson, S. N., & Roebuck, T. N. (2002). Acquisition and retention of verbal and nonverbal information in children with heavy prenatal alcohol exposure. *Alcoholism: Clinical and Experimental Research, 26*, 875-882.
- May, J. D. (1989). Questions as suggestions: The pragmatics of interrogative speech. *Language and Communication, 9*, 227-243.
- May, P. A., Gossage, P., Kalberg, W. O., Robinson, L. K., Buckley, D., Manning, M., & Hoyme, H. E. (2009). Prevalence and epidemiologic characteristics of FASD from various research methods with an emphasis on recent in-school studies. *Developmental Disabilities Research Reviews, 15*, 176-192.
- McClelland, J. L., & Goddard, N. H. (1996). Considerations arising from a complementary learning systems perspective on hippocampus and neocortex. *Hippocampus, 6*, 664-665.
- McCormick, C.B., & Kennedy, J.H. (1994). Parent-child attachment working models and self-esteem in adolescence. *Journal of Youth and Adolescence, 23*, 1-18.
- McFarlane, F., Powell, M. B., & Dudgeon, P. (2002). An examination of the degree to which IQ, memory performance, socio-economic status and gender predict young children's suggestibility. *Legal and Criminological Psychology, 7*, 227-239.
- Melinder, A., Endestad, T., & Magnussen, S. (2006). Development and aging: Relations between episodic memory, suggestibility, theory of mind, and cognitive inhibition in the preschool child. *Scandinavian Journal of Psychology, 47*, 485-495.
- Melinder, A., Scullin, M., Gravvold, T., & Iverson, M. (2007). The stability and generalizability of young children's suggestibility over a 44-month interval. *Psychology, Crime & Law, 13*, 459-468.
- Melnyk, L. (2002). *The influence of imagery, timing, and individual differences on the accuracy of children's recall*. Unpublished doctoral dissertation, McGill University, Montreal, Canada.

- Memon, A., Holley, A., Wark, L., Bull, R., & Köhnken, G. (1996). Reducing suggestibility in child witness interviews. *Applied Cognitive Psychology, 10*, 503-518.
- Meyer, J. R., & Reppucci, N. D. (2007). Police practices and perceptions regarding juvenile interrogation and interrogative suggestibility. *Behavioral Sciences and the Law, 25*, 757-780.
- Michel, M. M., Gordon, B. N., Ornstein, P. A., & Simpson, M. A. (2000). The abilities of children with mental retardation to remember personal experiences: Implications for testimony. *Journal of Clinical Child Psychology, 29*, 453-463.
- Miles, K. L., Powell, M. B., Gignac, G. E., & Thomson, D. M. (2007). How well does the Gudjonsson Suggestibility Scale for Children, version 2 predict the recall of false details among children with and without intellectual disabilities? *Legal and Criminological Psychology, 12*, 217-232.
- Milne, R., Clare, I. C. H., & Bull, R. (2002). Interrogative suggestibility among witnesses with mild intellectual disabilities: The use of an adaptation of the GSS. *Journal of Applied Research in Intellectual Disabilities, 15*, 8-17.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA). (1990). *Seventh special report to the U.S. congress on alcohol and health*. Washington D.C.: U.S. Government Printing Office.
- Newton, R. R., Litrownik, A.J., & Landsverk, J.A. (2000). Children and youth in foster care: Disentangling the relationship between problem behaviors and number of placements. *Child Abuse and Neglect, 24*, 1363-1374.
- Niccols, A. (2007). Fetal alcohol syndrome and the developing socio-emotional brain. *Brain and Cognition, 65*, 135-142.
- O'Connor, M.J., Kogan, N., & Findlay, R. (2002). Prenatal alcohol exposure and attachment behavior in children. *Alcohol Clin Exp Res, 26*, 1592-1602.
- O'Hare, E. D., Kan, E., Yoshii, J., Mattson, S. N., Riley, E. P., Thompson, P. M., Toga, A. W., & Sowell, E. R. (2005). Mapping cerebellar vermal morphology and cognitive correlates in prenatal alcohol exposure. *Developmental Neuroscience, 16*, 1285-1290.
- Olson, H. C., Feldman, J. J., Streissguth, A. P., Sampson, P. D., & Bookstein, F. L. (1998). Neuropsychological deficits in adolescents with fetal alcohol syndrome: Clinical findings. *Alcoholism: Clinical and Experimental Research, 22*, 1998-2012.

- Page, K. (2002). The invisible havoc of prenatal alcohol damage. *Journal of the Center for Families, Children & the Courts*, 67, 1-24.
- Pears, K., & Fisher, P.A. (2005). Developmental, cognitive and neuropsychological functioning in preschool-aged foster children: Associations with prior maltreatment and placement history. *Developmental and Behavioral Pediatrics*, 26, 112-122.
- Pears, K.C., Kim, H.K., & Fisher, P.A. (2008). Psychosocial and cognitive functioning of children with specific profiles of maltreatment. *Child Abuse and Neglect*, 32, 958-971.
- Pei, J. R., Rinaldi, C. M., Rasmussen, C., Massey, V., & Massey, D. (2008). Memory patterns of acquisition and retention of verbal and nonverbal information in children with fetal alcohol spectrum disorders. *The Canadian Journal of Clinical Pharmacology*, 15, e44-e56.
- Perlman, N. B., Ericson, K. I., Esses, V. M., & Isaacs, B. J. (1994). The developmentally handicapped witness: Competency as a function of question format. *Law and Human Behavior*, 18, 171-187.
- Pezdek, K., & Roe, C. (1995). The effect of memory trace strength on suggestibility. *Journal of Experimental Psychology*, 60, 116-128.
- Pollard, R., Trowbridge, B., Slade, P. D., Streissguth, A. P., Laktonen, A., & Townes, B. D. (2004). Interrogative suggestibility in a US context: Some preliminary data on normal subjects. *Personality and Individual Differences*, 37, 1101-1108.
- Rasmussen, C., Andrew, G., Zwaigenbaum, L., & Tough, S. (2008). Neurobehavioral outcomes of children with fetal alcohol spectrum disorders: A Canadian perspective. *Pediatrics and Child Health*, 13, 185-191.
- Rasmussen, C., Becker, M., McLennan, J., Urichuk, L., & Andrew, G. (2010). An evaluation of social skills in children with and without prenatal alcohol exposure. *Child: Care, Health and Development*, 37, 711-718.
- Rasmussen, C., Horne, K., & Witol, A. (2006). Neurobehavioral functioning in children with fetal alcohol spectrum disorder. *Child Neuropsychology*, 12, 453-468.
- Redlich, A. D., & Goodman, G. S. (2003). Taking responsibility for an act not committed: The influence of age and suggestibility. *Law and Human Behavior*, 27, 141-156.
- Redlich, A. D., Silverman, M., Chen, J., & Steiner, H. (2004). The police interrogation of children and adolescents. In G. Daniel Lensiter (Ed.), *Interrogations, Confessions*

and Entrapment (pp. 107-125). New York, NY: Springer Science and Business Media.

- Riikonen, R., Salonen, I., Partanen, K., & Verho, S. (1999). Brain perfusion SPECT and MRI in foetal alcohol syndrome. *Developmental Medicine and Child Neurology*, *41*, 652-659.
- Roberts, K. P., & Powell, M. B. (2005). The relation between inhibitory control and children's eyewitness memory. *Applied Cognitive Psychology*, *19*, 1003-1018.
- Roebuck, T. M., Mattson, S. N., & Riley, E. P. (1999). Behavioral and psychosocial profiles of alcohol-exposed children. *Alcoholism: Clinical and Experimental Research*, *23*, 1070-1076.
- Roper, R., & Shewan, D. (2002). Compliance and eyewitness testimony: Do eyewitnesses comply with misleading 'expert pressure' during investigative interviewing? *Legal and Criminological Psychology*, *7*, 155-163.
- Rosnow, R. L., & Rosenthal, R. (1989). Statistical procedures and the justification of knowledge in psychological science. *American Psychologist*, *44*, 1276-1284.
- Ruffman, T., Rustin, C., Garnham, W., & Parkin, A. J. (2001). Source monitoring and false memories in children: Relation to certainty and executive functioning. *Journal of Experimental Child Psychology*, *80*, 95-111.
- Sampson, P. D., Streissguth, A. P., Bookstein, F. L., Little, R. E., Clarren, S. K., Dehaene, P., Hanson, J. W., & Graham, J. M. (1997). Incidence of fetal alcohol syndrome and prevalence of alcohol-related neurodevelopmental disorder. *Teratology*, *56*, 317-326.
- Sánchez, M.M., Ladd, C.O., & Plotsky, P.M. (2001). Early adverse experience as a developmental risk factor for later psychopathology: Evidence from rodent and primate models. *Development and Psychopathology*, *13*, 419-449.
- Saner, H., & Ellickson, P. (1996). Concurrent risk factors for adolescent violence. *Journal of Adolescent Health*, *19*, 94-103.
- Sattler, J. (2008a). *Resource guide to accompany assessment of children: Cognitive Foundations, 5th edition*. La Mesa: California. Jerome M. Sattler, Publisher, Inc.
- Sattler, J. (2008b). *Assessment of children: Cognitive Foundations, 5th edition*. La Mesa: California. Jerome M. Sattler, Publisher, Inc.
- Saywitz, K. J., & Moan-Hardie, S. (1994). Reducing the potential for distortion of childhood memories. *Consciousness and Cognition*, *3*, 408-425.

- Scoboria, A., Mazzoni, G., Kirsch, I., & Milling, L. S. (2002). Immediate and persisting effects of misleading questions and hypnosis on memory reports. *Journal of Experimental Psychology: Applied*, 8, 26-32.
- Scullin, M. H., & Bonner, K. (2006). Theory of mind, inhibitory control and preschool-age children's suggestibility in different interviewing contexts. *Journal of Experimental Child Psychology*, 93, 120-138.
- Scullin, M. H., Kanaya, T., & Ceci, S. J. (2002). Measurement of individual differences in children's suggestibility across situations. *Journal of Experimental Psychology: Applied*, 8, 233-246.
- Shapiro, L. R., & Purdy, T. L. (2005). Suggestibility and source monitoring errors: Blame the interview style, interviewer consistency, and the child's personality. *Applied Cognitive Psychology*, 19, 489-506.
- Sheslow, D., & Adams, W. (2003). *Wide Range of Assessment of Memory and Learning – Second Edition: Administration and Technical Manual*. Wilmington, DE: Wide Range, Inc.
- Silvia, P. J. (2008). Another look at creativity and intelligence: Exploring higher-order models and probable confounds. *Personality and Individual Differences*, 44, 1012-1021.
- Singh, K.K., & Gudjonsson, G.H. (1984). Interrogative suggestibility, delayed memory and self-concept. *Personality and Individual Differences*, 5, 203-209.
- Snook, B., & Keating, K. (2011). A field study of adult witness interviewing practices in a Canadian police organization. *Legal and Criminological Psychology*, 16, 160-172.
- Snook, B., Eastwood, J., Stinson, M., Tedeschini, J., & House, J. C. (2010). Reforming investigative interviewing in Canada. *Canadian Journal of Criminology and Criminal Justice*, 52, 203-217.
- Sowell, E. R., Mattson, S. N., Thompson, P. M., Jernigan, T. L., Riley, E. P., & Toga, A. W. (2001). Mapping callosal morphology and cognitive correlates: Effects of heavy prenatal alcohol exposure. *Neurology*, 57, 235-244.
- Sowell, E. R., Thompson, P. M., Mattson, S. N., Tessner, K. D., Jernigan, T. L., Riley, E. P., & Toga, A. W. (2002). Regional brain shape abnormalities persist into adolescence after heavy prenatal alcohol exposure. *Cerebral Cortex*, 12, 856-865.
- Streissguth, A. (1997). *Fetal Alcohol Syndrome: A guide for families and communities*. Baltimore: Paul H. Brooks Publishing.

- Streissguth, A. (2007). Offspring effects of prenatal alcohol exposure from birth to 25 years: The Seattle Prospective Longitudinal Study. *Journal of Clinical Psychology in Medical Settings, 14*, 81-101.
- Streissguth, A. P., Aase, J. M., Clarren, S. K., Randels, S. P., LaDue, R. A., & Smith, D. F. (1991). Fetal alcohol syndrome in adolescents and adults. *Journal of American Medical Association, 265*, 1961-1967.
- Streissguth, A. P., Barr, H. M., Kogan, J., & Bookstein, F. L. (1996). Understanding the occurrence of secondary disabilities in clients with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE). Final report to Centers for Disease Control and Prevention. Seattle, WA: University of Washington School of Medicine.
- Streissguth, A. P., Barr, H. M., Olson, H. C., Sampson, P. D., Bookstein, F. L., & Burgess, D. M. (1994). Drinking during pregnancy decreases word attack and arithmetic scores on standardized tests: Adolescent data from a population-based prospective study. *Alcoholism: Clinical and Experimental Research, 18*, 248-254.
- Streissguth, A. P., Bookstein, F. L., Barr, H. M., Press, S., & Sampson, P. D. (1998). A fetal alcohol behavior scale. *Alcoholism: Clinical and Experimental Research, 22*, 325-333.
- Streissguth, A. P., Bookstein, F. L., Barr, H. M., Sampson, P. D., O'Malley, K., & Young, J. K. (2004). Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *Developmental and Behavioral Pediatrics, 25*, 228-238.
- Sternberg, R. J. (2002). The nature of creativity. *Creativity Research Journal, 18*, 87-98.
- Swayze, V. W., Johnson, V. P., Hanson, J. W., Piven, J., Sato, Y., Giedd, J. N., Mosnik, D., & Andreasen, N. C. (1997). Magnetic resonance imaging of brain anomalies in fetal alcohol syndrome. *Pediatrics, 99*, 232-240.
- Templeton, L. M., & Wilcox, S. A. (2000). A tale of two representations: The misinformation effect and children's developing theory of mind. *Child Development, 71*, 402-416.
- Thomas, S. E., Kelly, S. J., Mattson, S. N., & Riley, E. P. (1998). Comparison of social abilities of children with fetal alcohol syndrome to those of children with similar IQ scores and normal controls. *Alcoholism: Clinical and Experimental Research, 22*, 528-533.
- Tulving, E. (2002). Episodic memory: From mind to brain. *Annual Review Psychology, 53*, 1-25.
- United States General Accounting Office. (1997). *Parental substance abuse:*

Implications for children, the child welfare system, and foster care outcomes.
Washington, DC: Author. Retrieved from
<http://www.gao.gov/assets/110/107127.pdf>.

- Vrij, A., & Bush, N. (2000). Differences in suggestibility between 5-6 and 10-11 year olds: The relationship with self-confidence. *Psychology, Crime & Law*, 6, 127-138.
- Warren, A., Hulse-Trotter, K., & Tubbs, E. C. (1991). Inducing resistance to suggestibility in children. *Law and Human Behavior*, 15, 273-285.
- Wechsler, D. (2004). *Wechsler Intelligence Scale for Children—Fourth Edition: Canadian Manual*. Toronto, Ontario, Canada: PsychCorp.
- Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin*, 121, 331-354.
- White, R., & Wallner, P. (2005). Suggestibility and salience in people with intellectual disabilities: An experimental critique of the Gudjonsson Suggestibility Scale. *The Journal of Forensic Psychiatry and Psychology*, 16, 638-650.
- Wilkinson, L., Task Force on Statistical Inference, & APA Board of Scientific Affairs. (1999). Statistical methods in psychology journals: Guidelines and explanations. *American Psychologist*, 54, 594-604.
- Wright, A. M., & Alison, L. (2004). Questioning sequences in Canadian police interviews: Constructing and confirming the course of events? *Psychology, Crime, & Law*, 10, 137-154.
- Young, K., Powell, M. B., & Dudgeon, P. (2003). Individual differences in children's suggestibility: A comparison between intellectually disabled and mainstream samples. *Personality and Individual Differences*, 35, 31-49.
- Zajac, R., Jury, E., & O'Neill, S. (2009). The role of psychosocial factors in young children's responses to cross-examination style questioning. *Applied Cognitive Psychology*, 23, 918-935.
- Zimmer, H. D., & Cohen, R. L. (2001). Remembering actions: A specific type of memory? In H. D. Zimmer, R. L. Cohen, M. J. Gynn, J. Engelkamp, R. Kormi-Nouri & M. A. Foley. (Eds.), *Memory for Action: A Distinct form for of Episodic Memory?* (pp. 3-24). New York: Oxford University Press.