

## Indirect Behavioral Measures of Cognition among Sexual Offenders

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*Indirect measures of cognition have become an important tool in research on sexual offending. Such methods allow the exploration and testing of models of cognitive processes that might underpin sexual preferences and, in turn, sexual offending. The article reviews studies that have used a large range of indirect techniques (e.g., Implicit Association Test, Implicit Relational Assessment Procedure, Choice Reaction Times, Stroop Interference, Rapid Serial Visual Presentation, Lexical Decision Priming Task, and Viewing Times), and aims to discuss the strengths and weaknesses of this research.*

In this article, we aim to review some recent studies that have used indirect measures of cognition to test hypotheses related to sex offending. Before proceeding with the review, clear definitions of terms and limitations on the material included must be detailed.

### Sexual Offenders

The aim of this review is to evaluate the literature on indirect measures of cognition among sex offenders. Sex offenders are, however, far from a homogenous group. Perhaps the most obvious “division” that is often used in clinical and research settings is to distinguish between child sex offenders (those that have victims that are legally under the age of consent) and adult sex offenders (typically where a person has forced a non-consenting adult into a sexual act). For convenience, we term these two groups as “child-sex offenders” and “rapists” throughout the remainder of this review. Although researchers in both domains of sexual offending have begun to use indirect measures to examine theories of offender cognition and behavior, the literature is much less advanced within the rapist domain, with the majority of articles published referring to cognitions among child-sex offenders. As such, the focus of this review is on research findings pertaining to cognitions that may contribute to child-sex offenses in particular.

Of course, real offenders do not fall neatly into one of these two groups, and a person might have convictions

that cover both of these broad categories. Further, although we often use convictions to define our groups, we must recognize that we are likely to be missing many illegal behaviors that the person has not admitted to, not been convicted of, and so forth. There are also many acts (including convictions) that do not appear as sexually motivated, but may well actually be so. For instance, a person that breaks into another person’s house may only get charged with burglary, but the motive may well have been sexual in nature. Likewise, plea bargaining often means that a sexual element to an incident is dropped from the charges, and so on (see Rice, Harris, Lang, & Cormier, 2006).

### Cognition in Child-Sex Offenders

Researchers are keen to devise valid ways of measuring sex-offender cognitions that are not subject to the pitfalls of relying on explicit self-report (see below). The focus on cognition, in particular, is derived from the fact that several of the most influential theories of sexual offending consider deviant or abnormal cognitions to play a significant role in both its onset and maintenance (e.g., the Schema-Based Model of Sexual Assault [Mann & Beech, 2003]; the Integrated Theory of Sexual Offending [Ward & Beech, 2006]; the Judgment Model of Cognitive Distortions [Ward, Gannon, & Keown, 2006]; and the Implicit Theories Theory [Ward & Keenan, 1999]). Hence, a method that can index such cognitions, and is less prone to the problems of self-report, would be of great value in both advancing the theoretical basis of sex-offending and in aiding professionals to manage such offenders.

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### The Problem of Self-Report

Much psychological research depends on the technique of getting the person to tell us about themselves, their behaviors, and their thoughts and feelings. This research has told us much, but there are clearly limitations to this technique. First, it assumes that this information is available for us to report. Clearly, this is not true for much that happens in our mental life. Second, it may be difficult for many individuals to have insight into their behaviors and problems. Although we are all likely to suffer from this to some degree, certain offender groups may be particularly prone to this. For example, Cleckley (1941) noted that many psychopaths show a very poor ability to see themselves as others do.

Finally, self-report measures rely on the person being honest in their answers. Although even the best of us may be tempted to impression manage when asked to report on how patient or kind we are, sexual offenders often face much stronger motivations to minimize, distort, or deny the truth during such questionnaire-based assessments (Cooper, 2005). For example, their responses may be used to help determine treatment suitability or contribute to decisions concerning parole. To address this concern, researchers often rely on questionnaires that look for patterns of deliberate dissimulation (e.g., the Balanced Inventory of Desirable Responding [BIDR]; Paulhus, 1984, 1988), and then attempt to control for this within subsequent analyses. However, evidence suggests that statistically controlling for such socially desirable responding (SDR) does not always increase measure validity, and may even result in the removal of information pertaining to relevant personality characteristics such as levels of empathy, hostility, or denial (for a recent review, see Tan & Grace, 2008). In addition, against expectations, SDR has been found to negatively correlate with recidivism among offenders, such that those with a higher tendency to impression manage or self-deceive are less likely to re-offend (e.g., Mills, Loza, & Kroner, 2003). Although the meaning of this inverse relationship remains uncertain, it is clear that statistically controlling for SDR is by no means a definitive solution to the problems of relying on self-report, and that caution is still very much needed in interpreting such results (Tan & Grace, 2008). As such, alternative techniques that do not require an explicit response from participants, yet still reveal reliable information about underlying cognitions, may still be preferable.

### Indirect Measures of Cognition

Given the aforementioned pitfalls of explicitly, or directly, measuring cognitions among child-sex offenders, researchers have begun to utilize more indirect measures of cognition within this population. However,

before describing the diverse array of indirect measures available to such research, a distinction must be made between the measurement procedures themselves (indirect measures) and what they purport to measure (implicit measures).

Indirect measures are defined as those in which the participant is not asked to self-assess the attribute in question but, rather, the attribute is inferred by the researcher on the basis of some other participant response (De Houwer & Moors, 2010)—that is, whereas in direct measures the response itself is taken as an indicator of the attribute of interest, within indirect measurement there exists an additional stage of researcher inference between response and attribute. For example, in trying to assess self-esteem, a researcher could either utilize a direct measurement procedure, such as a multi-item Likert scale where the participants rate themselves on a list of associated qualities; or, alternatively, an indirect measurement procedure could be used (e.g., self-esteem could be inferred from the speed with which words are correctly classified as positive or negative following priming with self-referential concepts such as “me” and “myself”; e.g., see Spalding & Haldin, 1999). In this latter procedure, at no point do the participants provide an explicit rating of themselves as good or bad but, rather, their attitude toward themselves is inferred on the basis of reaction times across the two conditions.

This direct–indirect divide should not be confused with that of implicit–explicit measures. Explicit measures are outcomes of measurement procedures that allow the participant to deliberate. Thus, the participant has full and conscious cognitive access to the cognitions elicited by such techniques, such that they could report them to you with relative ease upon request. In contrast, implicit measures are outcomes of measurement procedures that are produced in an automatic manner. Participants are, thus, less aware of the cognitions elicited by these techniques, such that they may not even be aware of their existence (see Moors, Spruyt, & De Houwer, 2010). These explicit or implicit measures can include all manner of mental processes, including the attitudes and cognitions that are of interest to this review—that is, individuals likely possess cognitions that differ in their degree of cognitive access; some cognitive processes and attitudes will be explicit and available to conscious thought, whereas others will be beyond conscious access and be, thus, implicit in nature.

Given the aforementioned limitations of direct measures of cognition, it would seem likely that indirect measures would be better able to assess more implicit cognitions and attitudes. However, this suggestion by no means implies that indirect measurement is synonymous with implicit outcomes. On the contrary, indirect measures of cognition can be seen to vary in the degree to which they assess implicit cognitions (see De Houwer & Moors, 2010)—that is, just because a measure is

indirect in nature is not to say it is measuring implicit, rather than explicit, cognitions; the measure may well be measuring an explicit cognition of which the participant is consciously aware, but in an indirect manner. As such, this review is not an attempt to summarize what is known about *implicit* child-sex offender cognition but, rather, what has been learned about offender cognitions (which may be explicit or implicit in nature) using *indirect* techniques.

Having made this distinction, we now detail the types of indirect measurement procedures included in this review, and the selection criteria used to determine these. De Houwer (2003b, 2009; De Houwer & Moors, 2010) provided some very useful suggestions as to how to classify the diverse array of indirect measurement techniques that have developed over the last few decades of psychological research. Prior to such classification systems, indirect measures of cognition tended to be categorized merely on the basis of superficial similarities in presentation or content, without any appreciation for the more fundamental similarities and differences among such measures (De Houwer, 2003b). In contrast, De Houwer and Moors presented a series of classification criteria based on what they termed *internal* and *external* criteria (for further detail, see De Houwer & Moors, 2010).

Using the external criteria outlined by De Houwer and Moors (2010), the focus of this review is limited to discussing indirect behavioral measures of cognition. This decision naturally leads to the exclusion of direct measures of cognition, such as the self-report techniques discussed earlier. It also leads to the exclusion of symbolic indirect measures that analyze the meaning or content of a response, such as paradigms utilizing the reconstructive nature of memory or memory biases (e.g., Gannon & Rose, 2009; Gannon, Wright, Beech, & Williams, 2006; Keown, Gannon, & Ward, 2008a). Finally, the focus of this review also results in the exclusion of physiological indirect measures, including neurological investigations and the substantial literature on penile plethysmography (PPG) investigations (for a recent review, see Laws, 2009). According to the classification system presented by De Houwer and Moors, the remaining indirect behavioral measures of cognition can be further classified according to the type of stimulus response compatibility (SRC) they manipulate. This final external criterion is used to structure the presentation of indirect measures throughout this review, in an attempt to present procedures with presumably similar underlying processes (De Houwer, 2003b) in the same section.

Certain indirect measures manipulate the degree of correspondence between relevant target stimulus features (those that need to be attended to in order to make the correct response) and the required response; known as *Relevant SRC* tasks. Within such paradigms, participants can be reliably seen to respond more accurately

and rapidly when correspondence between the relevant target feature and required response is high. For example, when having to press specific buttons to indicate the location of a stimulus on screen, participants are more accurate when they have to press a left-hand button for left stimuli than when they are required to press a right-hand button for left stimuli (De Houwer, 2003b). Measures that utilize this type of SRC include the well-known Implicit Association Test (IAT), as well as the more recently developed Implicit Relational Assessment Procedure (IRAP).

Other measures manipulate the degree of correspondence between irrelevant features of the target (those features that are not related to making a correct response) and the required response; known as *Irrelevant SRC* tasks. Within such paradigms, despite their being irrelevant to the task at hand, participants can be seen to perform in a superior manner when correspondence between irrelevant target features and the required response is high. For example, even if participants are told to press a left-hand button for green words and a right-hand button for blue words, they are faster to do so when green words are presented to the left, rather than the right, of the screen; location of stimuli influences their performance, despite being irrelevant to the task at hand (De Houwer, 2003b). Measures that utilize this type of SRC include the IAT, the traditional Stroop paradigm, and affective priming (Simon tasks).

Yet another form of SRC concerns the degree of correspondence between different features of target stimuli and is termed Stimulus–Stimulus (S–S) Compatibility (De Houwer, 2003b). Within such paradigms, participants perform in a superior manner when stimuli within a task are related in some way (associatively, semantically, perceptually, etc.; Neely, 1991). For example, participants can be seen to more rapidly categorize a target following a conceptually related prime than following an unrelated prime. Measures that use this type of SRC include the Lexical Decision Priming Task (LDPT), the traditional Stroop paradigm, and associative priming.

As can be seen from the previous analysis, certain reaction time measures involve more than one type of SRC (e.g., the IAT involves both relevant and irrelevant SRC, and the traditional Stroop task involves both irrelevant SRC and S–S compatibility). This confounding of different SRC types marks an important distinction between these particular indirect measures and others that use only one type of SRC. Both single and dual SRC tasks are discussed in separate sections of this review.

Finally, additional indirect measures of cognition that meet the aforementioned criteria of measuring cognition in a non-symbolic and behavioral manner, yet do not utilize any of the aforementioned SRC types, are also reviewed in this article. These measures include Choice Reaction Time (CRT), the Emotional Stroop

(E-Stroop), and Rapid Serial Visual Presentation (RSVP) paradigms. What seems to unify these measures is the assessment of attentional capture by task-irrelevant stimuli; therefore, they are considered collectively within a separate section on attentional capture paradigms. The literature on measures of Viewing Time (VT) among child-sex offenders is also reviewed under this general section on attentional capture. Although differing from other attentional measures in that there is less focus on distraction and speed or accuracy of responding (Gress & Laws, 2009), the VT procedure still aims to assess the level of attention given to images of adults versus children at various stages of development; therefore, its findings seem most appropriately discussed within this final section. These measures were chosen for inclusion, despite lacking any observable SRC type, in an attempt to balance specificity with providing a representative review of the current research on child-sex offender cognition.

### Relevant-Irrelevant SRC Tasks

Certain indirect behavioral measures of cognition manipulate both relevant and irrelevant SRC. Thus far, research within the domain of child sexual offending has only utilized one such task: the IAT.

### IAT

Within the traditional IAT paradigm (Greenwald, McGhee, & Schwartz, 1998), participants are faced with a series of categorization tasks. During the first block of trials, they are required to classify stimuli (e.g., words, pictures, and sounds) as belonging to one of two categories, as rapidly as possible, using predefined response keys. For example, participants could be presented with a series of pictures and be asked to categorize them as either “male” or “female” individuals (by pressing the “A” or “B” keys, respectively). In the next block of trials, participants are required to make another series of categorization decisions, using the same predefined response keys, yet along a different dimension. For example, participants could be presented with a series of words and be asked to categorize them as either “sexy” or “not sexy” (again by pressing the “A” or “B” keys, respectively). Once these practice trials are completed, participants are required to simultaneously categorize the stimuli related to both dimensions of interest. For example, participants are presented with both male and female pictures *and* sexy and not-sexy words, and are told to press “A” if the item is male or sexy and to press “B” if the item is female or not sexy. Crucially, reaction times during this block of trials are compared to those in another block where the category pairings are reversed (e.g., press “A” for male or not-sexy stimuli, and press “B” for female or sexy

stimuli). Any resulting difference in average reaction times between these two blocks is known as the IAT effect, and is said to index cognitive associations held by the participant.

The logic behind this assumption is that when associated concepts share the same response key, responses during the dual categorization trials should be fast and accurate (representing cases of high SRC). In contrast, when associated concepts are assigned to different response keys, participants would be expected to experience response conflict, leading to slower and less-accurate responding (representing cases of low SRC). If there is no association between the concepts, then performance on the two blocks of trials should be the same, and no IAT effect should be produced. The IAT, thus, manipulates relevant SRC as, based on the underlying cognitive associations held by a participant, the two concepts—and the key associated with them—vary in compatibility.

The IAT also manipulates irrelevant SRC, but only within trials where the target of interest is being assessed (e.g., the male vs. female dimension in the previous example). Even within the dual categorization trials, participants are required to categorize these target stimuli in terms of some predefined semantic quality (in this case, the gender of the individual). However, their responses to these target stimuli may also be influenced by an irrelevant property of the stimuli presented, determined by the alternative meaning assigned to response keys within the other categorization task. For example, although the participant was instructed to press “A” for male images and “B” for female images, the speed of such responding may be influenced by the degree of correspondence between the image and the key’s other meaning—sexy versus not sexy. Thus, the speed with which the required response is given may also vary as a result of some task-irrelevant properties of the stimuli presented.

According to the logic of IAT paradigms, heterosexual males would be expected to respond more rapidly when the concepts of female and sexy shared the same response key than when the concepts of male and sexy shared the same response key, whereas homosexual males would be expected to evidence the opposite response pattern. An investigation by Snowden, Wichter, and Gray (2008) demonstrated not only that the IAT paradigm distinguished sexual orientation in precisely this manner, but that it did so with notable accuracy, generating a near-perfect Area Under Curve (AUC) of 0.97. Such an impressive result demonstrates the ability of the IAT to accurately characterize a person’s sexual interests and its potential to be used to explore theories of human sexuality.

Furthermore, during meta-analytic investigations beyond the domain of forensic psychology, the IAT paradigm has evidenced reasonable internal and test-retest reliability ( $\alpha = .79$  and  $r = .50$ , respectively;

Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Lanne, Banaji, Nosek, & Greenwald, 2007). Due to their increased susceptibility to error variance, reliability coefficients among reaction time-based measures tend to be lower than those produced for self-report-based measures (Buchner & Wippich, 2000). In light of this, the reasonable reliability coefficients produced by the IAT paradigm support its use as an indirect measure of child-sex offender cognition.

Armed with such a result, we went on to devise an IAT designed to assess whether a person more strongly associates sex with children or adults: the Child-Sex IAT (Gray, Brown, MacCulloch, Smith, & Snowden, 2005). Our aim was to determine whether such a measure could accurately distinguish between a group of child-sex offenders ( $n=18$ ) and offender controls ( $n=60$ ). The sex versus not-sex dimension was represented using words that were strongly associated with sex by offenders at the research site (e.g., cock or pussy) and words that were of a similar length and considered unrelated to sex (e.g., elbow or eye). The adult versus child dimension was represented using words associated with adults (e.g., beard or mature) and words associated with children (e.g., school or infant).

Results indicated that, whereas offender controls were faster to respond when the concepts of adult and sex shared a response key, child-sex offenders were faster to respond when the concepts of children and sex shared a response key. Despite the relatively small sample size, this difference in reported IAT effect was found to be statistically significant and represented a large effect size ( $d=0.84$ ). More important, these group differences were found to be specific to the child-sex IAT and were not evidenced within a control IAT assessing associations between the concepts of flowers versus insects and pleasant versus unpleasant, suggesting the results cannot be explained in terms of motivational, intellectual, or other non-specific differences between the groups (e.g., impulsivity). These results suggest that, unlike offender controls, those with a history of sexual crimes against children have a stronger association between children and sex than they do between adults and sex.

The calculated Receiver Operating Characteristic demonstrated that the child-sex IAT had a strong ability to distinguish child-sex offenders from offender controls ( $AUC=0.73$ ), but was not quite as accurate as other indirect measures of sexual interest, such as the PPG (reported AUC of 0.86; Blanchard & Bogaert, 1996). However, this difference may be due to our control group consisting of a mix of both violent and non-pedophilic sex offenders (i.e., rapists). These offenders may also possess some pedophilic tendencies not represented in their offense history, but detected nonetheless by our child-sex IAT. This could mean that some “false alarms” in fact reflected the detection of genuine pedophilic interest, meaning the reported AUC likely represents the lower limit of accuracy for our child-sex IAT.

One limitation of the previous study is its treatment of child-sex offenders as a homogenous group when research indicates their motivations are likely to differ (e.g., Beech, 1998; Marziano, Ward, Beech, & Pattison, 2006). For example, distinctions can be made between offenders with pedophilic interests (having a sexual preference for prepubescent children) and those with hebephilic interests (having a sexual preference for pubescent children). To address such a distinction, Brown, Gray, and Snowden (2009) re-administered the child-sex IAT to a larger group of child-sex offenders that were grouped based on the nature of their previous sexual offending into pedophilic offenders ( $n=54$ , defined as having any conviction for a sexual offense against a child less than 12 years of age) and hebephilic offenders ( $n=21$ , defined as only having sexual convictions against children between the ages of 12 and 15). These child-sex offenders were also compared to a group of non-sex offender controls ( $n=49$ ). The child-sex IAT was slightly modified within this investigation, as the adult-child dimension was represented using pictures rather than words, and the IAT procedure was shortened so that only the two critical stages (where both dimensions are simultaneously categorized) were presented. Previous research investigating the methodological properties of the IAT (Gray & Snowden, 2009) has found that, although neither of these modifications compromises its utility or efficacy, they place less demands on memory and other cognitive abilities, and so may be better suited to a broader range of populations (i.e., those with lower literacy).

As predicted, associations between children and sex were only found among the pedophilic-offender group, whereas both the hebephilic-offender group and offender controls demonstrated cognitive associations between adults and sex. These reported differences in IAT effect represented moderate to large effect sizes ( $d=0.77$  and  $0.92$ , respectively). Such results demonstrate how the child-sex IAT can distinguish different patterns of sex-related cognition that may characterize individual sex offenders, strengthening the possibility that it could eventually contribute to understanding sexual offending at both group and individual levels.

Within this investigation, we were also interested in whether claims the IAT is relatively resistant to deliberate dissimulation (e.g., Banse, Seise, & Zerbes, 2001; Cvencek, Greenwald, Brown, Gray, & Snowden, 2010; Steffens, 2004) would be upheld within a sex-offender population by comparing the IAT profiles of pedophilic offenders who admitted or denied their offenses. Offenders were classed as “admitters” or “deniers” on the basis of the classification system adopted by the HM Prison Service sex-offender treatment program (clinical interview and the Sex Offence Attitudes Questionnaire; Hogue, 1994). Results demonstrated that both admitters and deniers demonstrated an association between children and sex on the child-sex IAT; and that,

although the denier group significantly differed from the offender control group ( $d=1.01$ , representing a large effect size), they were statistically indistinguishable from the admitter group. Such results support the idea that the child-sex IAT is able to identify abnormal cognitive associations between sex and children even among offenders who deny their offenses, adding to the weight of evidence that IATs are resistant to deliberate dissimulation. However, given the confidential nature of the experimental procedure, it should not be assumed that these results would be replicated under conditions where the offenders may be more motivated to dissimulate (e.g., when IAT results would be placed in records or contribute to parole decisions; Brown et al., 2009). In addition, a more reliable index of pedophilic tendencies, such as PPG assessment, would be preferable in such experiments, as such interests may not be accurately captured by offense histories. However, in this particular instance, any misclassification would have resulted in greater similarity between the experimental groups, making significant differences less, not more, likely to be found (Brown et al., 2009).

Other research groups have produced similar findings, that those with a conviction for sexual crimes against children show stronger associations between children and sex than do offender controls; and support the idea that child-sex IATs may aid the detection of pedophilic tendencies.

Mihailides, Devilly, and Ward (2004) attempted to validate Ward's model of implicit cognition in sex offenders (see Ward, 2000; Ward & Keenan, 1999) by constructing a series of IATs designed to detect the presence of three proposed implicit theories among incarcerated male child-sex offenders ( $n=25$ ). It was predicted that if sex offenders do, indeed, possess such implicit theories or cognitive distortions, they should be faster than non-sex offenders ( $n=25$ ) and community controls (25 males and 25 females) to associate sex with children (children as sexual beings bias), sex with losing control (uncontrollability bias), and sex with first-person concepts (entitlement bias). Target dimensions were represented using words congruent with each cognitive distortion and their polar opposite. For example, the children as sexual beings IAT (the IAT closest to the child-sex IAT devised by our research group) was represented using a child versus not-child dimension, rather than a child versus adult dimension. Each target dimension was paired with a sexual versus nonsexual dimension according to the standard IAT procedure as previously described.

Within the children as sexual beings IAT, male child-sex offenders were found to have a stronger association between children and sex than were non-sex offender controls and both male and female community controls ( $d=0.63$ ,  $0.92$ , and  $0.97$ , respectively, representing moderate to large effect sizes). However, unlike the results reported by Gray et al. (2005), control

participants also demonstrated faster responding for child-sex pairings than not-child-sex pairings, and the child-sex offenders could only be distinguished by the fact that their IAT effect was significantly larger than that of controls (895 msec vs. 513 msec). The finding that controls also seemed to associate sex with children, albeit at a decreased magnitude compared to child-sex offenders, may be due to the decision to use not-child constructs (e.g., lids or rifle), rather than adult constructs, as the polar opposite of child within this IAT. As such, the results of this paradigm, although in accordance with those produced by Gray et al., are less clearly interpretable.

With regards to the other IATs constructed by Mihailides et al. (2004), child-sex offenders were found to possess stronger associations between sex and uncontrollability than did non-sex offenders and both male and female community controls ( $d=0.58$ ,  $0.97$ , and  $0.90$ , respectively, representing moderate to large effect sizes). However, significant differences for the entitlement IAT could only be found between child-sex offenders and male and female community controls ( $d=0.84$  and  $0.89$ , respectively, representing large effect sizes). It was suggested that a bias toward entitlement is more widely distributed among offender populations in general, which would explain why significant differences between offender samples were not found within the IAT. In summary, the results of Mihailides et al. suggested male child-sex offenders have stronger associations between sex and uncontrollability and (in line with the results produced by Gray et al., 2005) between sex and children than do offenders with no history of sexual offenses against children.

Nunes, Firestone, and Baldwin (2007) also used IATs to examine the cognitive associations of sex offenders in an attempt to validate theories that propose men who sexually abuse children do so because they see themselves as weak, negative, and unattractive, yet see children (relative to adults) as weak, positive, and attractive (e.g., Finkelhor, 1984; Finkelhor & Araji, 1986; Hall & Hirschman, 1992; Marshall & Barbaree, 1990). They devised a series of IATs to assess differences concerning such associations between child-sex offenders ( $n=27$ ) and nonsexual-offender controls ( $n=29$ ). The IATs assessing cognitions related to children included the "Sexy-Child IAT" (pairing the dimensions of child vs. adult and sexy vs. not sexy), the "Pleasant-Child IAT" (pairing the dimensions of child vs. adult and pleasant vs. unpleasant), and the "Powerful-Child IAT" (pairing the dimensions of child vs. adult and powerful vs. weak). The IATs assessing cognitions related to the self included the "Sexy-Self IAT" (pairing the dimensions of me vs. not me and sexy vs. not sexy), the "Pleasant-Self IAT" (pairing the dimensions of me vs. not me and pleasant vs. unpleasant), and the "Powerful-Self IAT" (pairing the dimensions of me vs. not me and powerful vs. weak).

Only one of the IATs demonstrated a significant difference between the child-sex offenders and non-sex offender controls: the sexy-child IAT. As previously reported (Gray et al., 2005; Mihailides et al., 2004), child-sex offenders were faster to respond when the concepts of child and sex were paired than when adult and sex were paired, suggesting a stronger association between children than adults with sex. In contrast, non-sex offender controls demonstrated a nonsignificant difference in the opposite direction (i.e., indicating a trend toward stronger adult-sex associations than child-sex associations). The difference between these two IAT effects was found to be significant, and represented a moderate effect size ( $r = .33$ ). In further support of the resistance of IAT paradigms to deliberate dissimulation, it was also found that, despite child-sex offenders scoring significantly higher on the impression management subscale of the BIDR (Paulhus, 1984), controlling for such elevated scores did not alter the direction or magnitude of group differences.

Nunes and colleagues (2007) also reported that scores on the sexy-child IAT significantly correlated with scores on the Static-99 (Hanson & Thornton, 2000; an actuarial measure designed to assess the risk of sexual recidivism), such that IAT scores indicative of a stronger association between children and sex were associated with higher risk of sexual recidivism. Such a result suggests IATs assessing the cognitive associations between children versus adults and sex may have some ability to predict future offending. However, due to the correlational nature of these findings, direct prospective tests of this hypothesis are required before any firm conclusions about causality can be made. Correlations with another actuarial measure of sexual recidivism risk (the Rapid Risk Assessment for Sexual Offense Recidivism; Hanson, 1997) indicated that offenders with stronger associations between children and power (powerful-child IAT) were also at greater risk for sexual re-offense.

Such findings do not provide strong support for theories suggesting child molestation occurs due to perceiving the self as weak, unattractive, and negative (none of the “self” orientated IATs produced any significant effects), nor the idea that children must be seen as weak, non-threatening targets for sexual offending to occur. They do, however, add further support to the idea that child-sex offenders hold stronger associations between children and sex than do other offender controls.

Steffens, Yundina, and Panning (2008) also used the IAT paradigm to examine the cognitive associations held by sexual offenders, to look at those designated as “primarily pedophile” ( $n = 17$ ), “primarily rapist” ( $n = 21$ ), and “intermediate” by their primary psychologist. As well as investigating associations between the dimensions of erotic versus not erotic and child versus woman, they also examined the hypothesis that rapists would have a stronger association than child-sex offenders and male student controls ( $n = 47$ ) between

humiliation and sex by constructing a harmony (vs. humiliation)-erotic IAT. These researchers were also interested in whether these erotic IATs could distinguish those considered in danger of relapse if immediately released ( $n = 30$ , also determined by primary psychologist ratings).

Against predictions, no significant differences were found between rapists, pedophiles, and students within the harmony-erotic IAT. This may be due to methodological issues. For example, humiliation does not have as clear a polar opposite as other dimensions used within IAT paradigms (i.e., gender or age group; Steffens et al., 2008). Also against predictions, the overall child-erotic IAT did not produce significant differences between offenders and student controls. However, once data analysis was restricted to those offenders classified by their primary psychologist as primarily pedophilic, a significant difference was found, such that these offenders demonstrated a stronger association between children and erotic than did intermediate offenders ( $R_p^2 = .23$ , representing a large effect size). Those offenders considered at risk of relapse in the case of immediate release were also found to have stronger child-erotic associations ( $R_p^2 = .19$ , representing a large effect size). Scores on the child-erotic IAT also demonstrated some incremental validity within regression analyses in predicting risk of relapse. Steffens et al. acknowledged that, due to offender classifications of sexual interest and risk of relapse being made on the rather subjective basis of psychologist ratings, their results are limited, and replication is required against more reliable and valid assessment criteria. This study is also limited by its use of female-only stimuli, meaning homosexual pedophilic or sexually sadistic tendencies may have gone undetected.

Banse, Schmidt, and Clarbour (2010) also examined the validity of IAT paradigms in distinguishing child-sex offenders from offender and community controls as part of their battery of implicit and explicit measures: the Explicit and Implicit Sexual Interest Profile (EISIP). The EISIP was devised due to concerns over the ability of researchers and clinicians to draw firm conclusions regarding any psychological attribute based on the results of just one indirect measurement. It contains four explicit questionnaire-based measures of sexual interest, three different IATs designed to assess associations between sexual excitement and men versus women, women versus girls and men versus boys, as well as four different VT measures (see the following) designed to assess sexual interest in men, women, boys, and girls. The test battery was administered to a group of child-sex offenders ( $n = 38$ ), offender controls ( $n = 37$ ), and community controls ( $n = 38$ ).

Although the entire EISIP test battery demonstrated impressive discriminatory validity ( $AUC = 0.95$ ), the IAT measure performed at a modest level. In comparing child-sex offenders to all controls (both offender and

community,  $n=75$ ), the boys–men IAT produced a small AUC of 0.62, the girls–women IAT produced a large AUC of 0.72, and the averaged children–adults IAT produced a moderate to large AUC of 0.71. The IAT measures were, however, found to significantly correlate with the Screening Scale for Paedophilic Interests (Seto & Lalumiere, 2001), suggesting some convergent validity. Once again, level of SDR, as measured by the BIDR (Paulhus, 1984), was found to be unrelated to the IAT effects produced, providing further support for the IAT as a paradigm that is relatively resistant to deliberate dissimulation.

Each of the prior investigations has examined the ability of IAT paradigms to discriminate between incarcerated child-sex offenders and offender controls. A recent study by van Leeuwen et al. (2009) investigated whether the procedure showed similar discriminative validity among non-incarcerated males with pedophilic interests. Participants were recruited using a confidentiality agreement from a Dutch organization of self-professed pedophiles ( $n=20$ , defined as admitting to engaging in sexual fantasies about specific children in their community or children in general, or having engaged in sexual contact with a child [ $n=9$ ]). In comparison to a group of non-pedophilic community controls ( $n=20$ ), these self-acclaimed pedophiles demonstrated a pattern of responding within the IAT that mirrors results obtained for incarcerated child-sex offenders (e.g., Gray et al., 2005)—that is, pedophilic males were faster to respond on trials where the concepts of children and sex shared a response key than on trials where the concepts of adults and sex shared a response key. In contrast, control participants showed the opposite pattern of responding. The reported AUC of 0.89 is even higher than that found within incarcerated samples, and represents a large effect size, suggesting that the IAT's validity may be even higher among these people who not only admit to their pedophilic fantasies, but also join such an organization. They also provide further evidence of the potential for IAT procedures to contribute toward identifying deviant sexual interest in children.

Each of the prior investigations has limited its application of IAT paradigms to male child-sex offenders only, leaving questions as to whether such designs can reliably and accurately measure female child-sex offender cognition unanswered. In addition, the relative dearth of research into female sex-offender cognition, in general, has led to reliance on treatment practices based predominantly on empirical data derived from male participants. There are strong theoretical reasons why IAT results may be expected to differ among female child-sex offenders. For example, unlike male child-sex offenders, female child-sex offenders are theorized to be less motivated by a sexual attraction to children and are considered less likely to sexualize children and their behaviors (e.g., Nathan & Ward, 2001; Wakefield &

Underwager, 1991). As such, the well-replicated finding that male child-sex offenders associate children and sex within designs such as the IAT (e.g., Gray et al., 2005; Mihailides et al., 2004; Nunes et al., 2007) may not be reproduced within female child-sex offender populations.

Gannon, Rose, and Williams (2009) applied the child-sex IAT paradigm to a group of female child-sex offenders ( $n=17$ , defined as having committed a sexual offense against a child) and female offender controls ( $n=17$ , defined as having never been convicted of a sexual offense against a child). Results demonstrated that both groups held stronger associations between adults and sex than children and sex, that the groups could not be statistically distinguished in terms of the performance on the child-sex IAT, and that these effects held even when examining only those female offenders with victims under the age of 11 ( $n=8$ ). These results contrast with those reported for male child-sex offenders and suggest that, unlike their male counterparts, female child-sex offenders do not hold abnormal associations between children and sex. Given the prevailing clinical view that female child-sex offenders offend for reasons other than sexual attraction to children (Gannon et al., 2009), these null results do not necessarily invalidate the IAT as a reliable index of abnormal cognitive associations that may contribute to sexual offending, but may suggest its ability to detect abnormal sexual interest in children.

In summary, studies of child-sex offender cognition that manipulate both relevant and irrelevant SRC are currently limited to those utilizing the IAT paradigm. At this time, such studies consistently suggest that male child-sex offenders possess stronger associations between children and sex than do offender or community controls. However, in contrast, initial investigation using the same paradigm among female child-sex offenders has failed to support such a contention (Gannon et al., 2009). Further investigations using the IAT paradigm in male child-sex offenders suggest other potentially maladaptive associations between sex and uncontrollability (Mihailides et al., 2004) and children and power (Nunes et al., 2007).

Despite such promising results suggesting a place for IAT paradigms in the assessment of sexual offenders, the measure is not without its limitations. First, evidence of an association between children and sex is not definitive proof of an abnormal sexual interest in children. A person could hold such an association for several other incidental reasons. For example, an expectant mother might reasonably be expected to possess a stronger than average association between children and sex (Gray & Snowden, 2009). More specifically, in the case of sex offenders, many are required to discuss the concepts of children and sex within therapy sessions, which may mean the association detected by IAT procedures is simply a by-product of this process, rather than some



pre-existing bias or distortion (Gray & Snowden, 2009). However, the results of Brown and colleagues (2009) argue against this interpretation, as associations between children and sex were *not* found among hebephilic offenders, despite their engagement in such therapy sessions, and *were* reported among participants who denied their offences, disqualifying them from receiving such interventions according to current U.K. Sex Offender Treatment Program protocol. As another example, rather than reflecting a tendency to sexualize children, an observed association between children and sex within an IAT could be the result of a personal history of childhood abuse (Gawronski, 2009). Early experience of sexual activity may conceivably result in an association between children and sex within that particular participant, providing an alternative explanation for the results observed. Furthermore, a large proportion of child-sex offenders tend to have experienced such victimization during their own childhoods (Hanson & Slater, 1988), making this potential confound of particular relevance among such populations. Notwithstanding this possibility, a significant relationship exists between personal victimization as a child and later being convicted of child-sex offenses, meaning that the relative and combined influences of personal childhood victimization and genuine sexualization of children are difficult to tease apart within paradigms such as the IAT. However, it should be noted that the research has shown that some subgroups of sex offenders (females and males with victims over 12 years) do not show this IAT result, although there is no evidence that these groups suffered any less abuse. Until the true nature of the associations revealed by IAT paradigms is determined, caution should be used in interpreting any results generated.

Second, despite paradigms such as the child-sex IAT generally producing moderate to large AUCs when retrospectively discriminating between male child-sex offenders and controls, we do not yet have any prospective data on the predictive utility of the IAT. Such investigations are warranted before IAT paradigms can be confidently used to help identify child-sex offenders.

Third, the IAT is limited by its relational, rather than absolute, nature. The data produced by the prior investigations inform us that male child-sex offenders more strongly associate children with sex than they do adults. However, this difference could reflect either an increased attraction to children or a decreased attraction to adults. An absolute index of associations held by the offender would be valuable. Unfortunately, attempts to re-score the IAT to reflect such absolute associations have proven unsuccessful (Nosek, Greenwald, & Banaji, 2005). However, alternative paradigms, such as the Go/No-Go Association Task (GNAT; Nosek & Banaji, 2001) and the Extrinsic Affective Simon Task (EAST; De Houwer, 2003a), may help address this limitation of the IAT

paradigm. These measures are conceptually related to the IAT, yet allow absolute associations to be measured by only assessing attitudes toward a single construct at a time and have shown some initial promise within the domain on sexual offending. For example, in line with IAT-based findings, Snowden, Gray, Brown, and Power (2007) found some preliminary evidence that child-sex offenders hold stronger associations between children and sex on a modification of the GNAT than do rapists and non-sex offender controls. Despite circumventing some of the known limitations of IAT procedures, results from paradigms such as the GNAT and EAST should be cautiously interpreted, given their generally low split-half reliability (GNAT,  $r = .20$ ; Nosek & Banaji, 2001; EAST,  $r$  ranges from  $-.20$  to  $.69$ ; De Houwer & De Bruycker, 2007).

### Relevant SRC Tasks

Another alternative paradigm for assessing sex-offender cognition was introduced by Dawson, Barnes-Holmes, Gresswell, Hart, and Gore (2009): the IRAP (Barnes-Holmes et al., 2006). The IRAP represents a form of RT task in which compatibility is only manipulated between the required response and relevant aspects of the target stimulus.

### IRAP

Within the IRAP, participants are required to rapidly categorize a simple statement (e.g., “Child–Sexual?” or “Adult–Nonsexual?”) as being true or false based on the current trials reinforcement contingency. Relevant SRC is manipulated across trials by altering this reinforcement contingency. During “consistent” trials, participants are instructed to respond in a way that is consistent with social norms (i.e., adults as sexual and children as not sexual), whereas during “inconsistent” trials, the contingencies are reversed to reflect associations at odds with social standards (i.e., children as sexual and adults as not sexual). Throughout the procedure, the participant is exposed to all possible construct combinations (i.e., child–sexual, child–not sexual, adult–sexual, and adult–not sexual) so that each form of belief can be independently assessed, making the IRAP an absolute, rather than relative, measure of cognitive associations.

The rationale behind the IRAP is that, as our initial response to such statements is likely to reflect internal beliefs that we hold, response latencies for most people will be shorter during consistent than inconsistent trials. This is because during inconsistent trials our initial response is less likely to match the key we have been told to press. As an example, during a consistent trial, participants would be instructed to respond in accordance to social norms and, therefore, to press “false” on seeing

the statement, “Children–Sexual?” As this contingency is in accordance with most people’s internal beliefs, participants should rapidly respond to the statement (as it represents an example of high SRC). However, during inconsistent trials, participants would be required to press “true” on seeing this statement. As this would presumably go against most people’s beliefs and, thus, immediate reaction to the statement, they should take longer to press the instructed button under this condition than the previous one (as it represents an example of low SRC). The observed difference between consistent and inconsistent trials is taken to index the strength of the belief being assessed (e.g., that children are sexual). As a relatively new indirect measure, detailed meta-analytic information on the psychometric properties of the IRAP is still lacking. However, a recent study examining the ability of an IRAP paradigm to correctly identify vegetarian and meat-eating participants reported a reasonable split-half reliability, comparable to the reliability estimates produced for the more established IAT paradigm ( $r = .72$ ; Barnes-Holmes, Murtagh, & Barnes-Holmes, 2010).

Dawson and colleagues (2009) investigated whether the IRAP could correctly identify offenders convicted of a sexual offense against children more effectively than an explicit measure of offender cognition: the Cognitive Distortion Scale (CDS; Gannon, 2006). They administered the IRAP to a group of community-based male child-sex offenders recruited using the U.K. National Probation Service ( $n = 16$ ) and a group of male community controls ( $n = 16$ ). Results showed that, although both offender and control groups demonstrated a positive IRAP score (indicating an association between adults and sex), this bias in controls was double that demonstrated by the male child-sex offenders. In other words, male child-sex offenders are significantly impaired in associating adults with sex compared to university control participants. Crucially, although control participants demonstrated a significant IRAP effect for the child–sexual trial type, the child-sex offenders failed to do likewise (no effect size reported), suggesting they are unable to discriminate children as sexual or nonsexual. Although not quite as compelling as the IAT data indicating child-sex offenders associate children with sex, the finding that they are significantly less likely to associate adults with sex on an absolute indicator of cognitive associations adds support to the idea that child-sex offenders hold abnormal cognitions about who qualifies as an appropriate sexual partner (Dawson et al., 2009).

The IRAP’s discriminative validity was found to be nonsignificantly less than that reported for the IAT, with offenders being correctly classified only 68.8% of the time at the expense of misclassifying controls 43.7% of the time (as compared to the IAT correctly classifying 78% of pedophiles and incorrectly categorizing 42% of the control participants; Gray et al., 2005).

However, the IRAP was still found to perform more favorably than the CDS (Gannon, 2006), which failed to produce significant differences in the number of cognitive distortions reported by offenders and controls (in fact, controls were found to endorse (nonsignificantly) more distortions than the offenders!). The results of this investigation demonstrate the potential for indirect paradigms other than the IAT to index abnormal sexual associations.

### S–S Compatibility Tasks

S–S compatibility is manipulated within tasks such as the LDPT and associative priming paradigms. Although the LDPT has been previously used in attempts to understand child-sex offender cognition, such research has yet to utilize associative priming paradigms, meaning this latter paradigm is not discussed in this review.

#### LDPT

Within the discipline of cognitive psychology, LDPT has shown that people are faster at identifying a string of letters as a word (rather than a non-word) when the target string represents a word that is semantically related to a preceding prime. For example, participants will more rapidly identify the string of letters b-u-t-t-e-r as a real word if it is presented after a semantically related prime, such as *bread*, than if it is presented after a semantically unrelated prime, such as *elbow* (Meyer & Schvaneveldt, 1971). As another example, participants more rapidly identify a word as real if it follows on logically from a priming sentence. For example, following the presentation of “John ate the . . .,” participants will more rapidly confirm f-o-o-d is a real word than they will f-o-o-t (Forster, 1981). Further analysis of this effect has revealed it is based on the cognitive associations and schema held by an individual participant—that is, facilitation of word identification only occurs if the individual expects it as the logical completion of the preceding sentence (Keown, Gannon, & Ward, 2008b). As such, the LDPT may be used as an implicit means of assessing cognitive associations or schema held by an individual or population of interest. LDPT represents an example of S–S compatibility tasks in that the level of compatibility between the priming word or sentence (irrelevant feature of stimulus) and target word (relevant feature of stimulus) varies across trials based on the cognitive associations held by the participant.

Keown and colleagues (2008b) utilized LDPT to examine whether child-sex offenders evidenced possession of the five implicit theories proposed by Ward and Keenan (1999). These include the “children as sexual beings,” “uncontrollability,” “nature of harm,” “entitlement,” and “dangerous world” implicit theories. Child-sex offenders ( $n = 32$ ), offender controls ( $n = 37$ ),

and community controls ( $n = 31$ ) were presented with a series of priming sentences and asked to identify whether the following string of letters represented a real or non-word. The real words presented to participants either completed the sentence in an offense-supportive (reflecting one of Ward & Keenan's, 1999, five implicit theories) or unsupportive way. For example, the sentence, "Having sex with children won't do them any . . .," was either followed by the word *harm* (offense supportive), *good* (non-offense supportive), or the non-word *knid*. On the premise that people use their cognitive schemas to anticipate sentence endings (e.g., Duffy, 1986), it was hypothesized that child-sex offenders would be faster to identify offense-supportive words as real than they would non-offense-supportive words.

When examining the data across sentences representing all five cognitive distortions, these predictions were not supported, as groups could not be distinguished on the basis of their response times to offense-consistent versus offense-inconsistent words. In fact, child-sex offender response times suggested they held offense-inconsistent schema, as—like offender and community controls—they were faster to identify the non-offense-supportive words as real than the offense-supportive ones. When individually examining the five implicit theory categories, significant differences were only reported for sentences representing the "uncontrollability" bias. Within this category, child-sex offenders were found to more rapidly identify offense-consistent words as real, whereas both offender and community controls more rapidly identified offense-inconsistent words as real (no effect sizes reported). However, this difference only reached significance between child-sex offenders and offender controls, not community controls. The difference was predominately carried by the offender controls, demonstrating strong opposition to the uncontrollability bias, rather than the child-sex offenders strongly agreeing to it. Such results suggest that child-sex offenders may be less likely to hold distorted beliefs or maladaptive implicit theories than previously thought, and that additional mechanisms are likely to contribute to their offending (Keown et al., 2008b).

Kamphuis, De Ruiter, Janssen, and Spiering (2005) also used the LDPT to examine the proposition that male child-sex offenders possess automatic links between sex and power (e.g., Bargh, Raymond, Pryor, & Strack, 1995). Male child-sex offenders ( $n = 10$ ), violent offender controls ( $n = 15$ ), and community controls ( $n = 20$ ) were subliminally primed with either sex-related, power-related, or neutral words prior to completing a lexical decision task on another selection of sex-related, power-related, or neutral words. It was hypothesized that for child-sex offenders exclusively, priming the concepts of power and sex would have reciprocal facilitating effects on the identification of such words within the LDPT (e.g., priming power would facilitate identification of sex-related words and vice versa).

In line with predictions, child-sex offenders were found to experience a sex-to-power facilitation effect—that is, child-sex offenders were significantly faster at identifying power-related words within the LDPT when primed with sex-related words than when not. These child-sex offenders experienced a significantly greater level of facilitation than did offender controls and a marginally significant level of facilitation than did community controls ( $p = .051$ ; no effect size reported). Child-sex offenders also demonstrated a trend toward the reverse power-to-sex facilitation effect (no effect sizes reported). Such findings may represent a key pathological link between the concepts of sex and power in the cognition of men who offend sexually against children (Kamphuis et al., 2005) and demonstrate the power of the LDPT to reveal such associations. However, due to the preliminary nature of such findings, it may be some time before LDPT paradigms are validated for use at the individual, rather than group, level (Kamphuis et al., 2005). In addition, more detailed analyses of the general psychometric properties of semantic priming procedures, such as the LDPT, have revealed only modest reliability at best (e.g.,  $r = .38$ ), suggesting caution should be exercised in interpreting results produced by such paradigms (Stolz, Besner, & Carr, 2005).

### Irrelevant SRC and S-S Compatibility Tasks

Certain reaction time tasks are considered to confound irrelevant SRC and S-S compatibility, meaning that both types of SRC are varied across trials such that the influence of one type cannot be isolated from the other. Traditional Stroop paradigms and affective priming procedures represent examples of such tasks. At this time, research utilizing the affective priming procedure among child-sex offenders is lacking; thus, only results produced using the traditional Stroop paradigm are discussed presently.

#### Traditional Stroop Paradigm

Within the classic Stroop paradigm (see Stroop, 1935), participants are presented with a series of words and are asked to report the color of ink in which the word is written, ignoring any potential word meaning. Well-replicated findings demonstrate that their ability to name the ink color is compromised if the word itself represents another color (i.e., participants will demonstrate longer response latencies when presented with the word *green* written in blue than the word *bread* written in blue; Stroop, 1935). As in some trials the word (relevant feature of target) and its ink color (irrelevant feature of target) are related, whereas in others they are unrelated, Stroop tasks can be said to manipulate S-S compatibility. However, as the ink color is, in fact,

irrelevant to the task at hand (reading the word aloud), traditional Stroop tasks can also be said to vary the degree of correspondence between the required response and some irrelevant feature of the target (irrelevant SRC).

Van Leeuwen et al. (2009) used a modified version of this classic Stroop paradigm to examine potential cognitive biases possessed by their sample of self-professed pedophiles (see the previous IAT section). Within this paradigm, participants were required to categorize words as either sexual or nonsexual while they were superimposed on either images of an adult or a child. Faster categorization was taken as indicative of a greater association between sex and a given trial type (i.e., adult vs. child images). Bias scores, calculated by comparing response latencies across picture types, revealed that the self-acclaimed pedophiles were faster to categorize words as sexual when they were imposed on an image of a child, whereas controls were faster when imposed on an image of an adult, suggesting that these non-incarcerated pedophiles have abnormal associations between children and sex not possessed by male community controls. The reported AUC of 0.84 also demonstrates the relatively high level of accuracy with which pedophiles could be distinguished from controls using this Stroop-based paradigm. Furthermore, when combined with the results of the child-sex IAT also completed by these participants, the AUC increased to an impressive 0.97, demonstrating that, among this sample of admitting pedophiles, a combination of indirect measures can almost perfectly distinguish between those with and without deviant sexual interests in children. Whether such findings can be replicated within populations with greater motivation to dissimulate remains to be seen.

To the best of our knowledge, this study by van Leeuwen et al. (2009) represents the only application of the more traditional Stroop paradigm to the study of child-sex offenders at this time. Thus, despite the impressive AUC reported within this investigation, the results should be considered preliminary pending replication within larger, more homogenous child-sex offender samples. In addition, picture-word variants of the traditional Stroop paradigm tend to evidence poor test-retest reliability when scores are calculated using bias scores rather than raw response latencies (e.g.,  $r = .26$ ; Strauss, Allen, Jorgensen, & Cramer, 2005), further emphasizing the need for caution in interpreting these results.

### Tasks of Attentional Capture

As discussed in the general introduction to this review, the literature on the indirect assessment of child-sex offender cognition contains articles using a range of behavioral measures that, although not clearly

belonging to any of the SRC types previously discussed, remain of relevance to this review. These tasks include CRT, E-Stroop, and traditional RSVP paradigms, as well as the considerable literature using VT procedures.

### CRT

CRT paradigms utilize a phenomenon known as a Sexual Content-Induced Delay (SCID) in an attempt to identify individuals with deviant sexual interests. SCID describes a form of attentional bias that occurs when the presentation of salient, sexually arousing stimuli interferes with the processing of other target stimuli or the completion of some other task (Geer & Bellard, 1996). Studies within the general population have revealed that the level of SCID experienced by participants in response to male versus female images can reliably identify sexual orientation (e.g., Santtila et al., 2009, reported an AUC of 0.82). Within CRT procedures, participants are typically required to determine the location of some stimulus on the computer screen (e.g., a white dot), and the time taken to make this decision is compared across conditions with varying images imposed on the screen background (e.g., neutral, child, or adult images). Based on the principles of SCID, conditions during which the participant takes longer to locate the white dot are considered to reflect stronger sexual interest in the images used. For example, a heterosexual male would be expected to take longer to locate the white dot during trials in which the task is imposed on images of women than men, whereas homosexual men would be expected to display the reverse pattern of responding.

Researchers have begun to conduct CRT-based investigations in sex-offender populations to determine its validity as a means of identifying deviant sexual interests. For example, Giotakis (2006) administered a CRT task to child-sex offenders ( $n = 27$ ; intrafamilial,  $n = 8$ ; extrafamilial,  $n = 19$ ), rapists ( $n = 31$ ), community control males ( $n = 53$ ), and community control females ( $n = 24$ ). Participants were required to identify the location of a white dot as either to the left or right of the screen as quickly as possible while a range of images were displayed in the background. Results demonstrated that extrafamilial child-sex offenders took longest to locate the dot during trials where images of prepubescent girls were present, but intrafamilial child-sex offenders (and female controls) took longest during trials where images of adolescent females were present. Rapists and control males, on the other hand, showed slower CRTs when the task was imposed on images of adult women (no effect sizes reported). Such findings suggest that different subtypes of sexual offenders can be distinguished by their pattern of SCID within CRT tasks.

Mokros, Dombert, Osterheider, Zappalà, and Santtila (2010) also assessed the ability of a CRT-based

measure to detect pedophilic interests among a sample of child-sex offenders ( $n=21$ ) and non-sex offenders ( $n=21$ ) hospitalized within high-security forensic psychiatric hospitals. Using the typical CRT procedure previously described, they found that, whereas non-sex offenders took longer to identify the position of an orange dot when it was superimposed on adult images (compared to child images), child-sex offenders took longer to judge the location of the dot when presented on an image of a child rather than an adult. This finding produced a moderate effect size ( $\eta_p^2 = 0.11$ ). In support of the idea that this interference reflects the sexual interests of participants, both groups were also found to take longer to respond during trials involving nude images than clothed ones. The calculated “preference index” (performance within child trials minus that within adult trials) produced an AUC of 0.84 when discriminating between child-sex offenders and offender controls. This further increased to an impressive 0.998 after controlling for the significant covariates of age and verbal IQ, with perfect sensitivity and 95% specificity when using  $-45$  msec as the preference index cutoff point to indicate pedophilic interests. Such findings suggest that CRT tasks can discriminate well between those with and without a history of sexual offenses against children.

The previous findings show reasonable promise that CRT measures may someday assist in the identification of offenders with deviant sexual interests. Furthermore, CRT measures seem to demonstrate strong internal reliability, further strengthening their potential as an indirect measure of cognition or sexual interest. For example, Wright and Adams (1994) reported highly reliable stimulus categories with all alphas above .90 in a study using CRT to identify sexual preference among the general population. However, given the small number of studies that have been conducted thus far, further replication among a wider variety of populations, as well as evidence of this technique’s predictive validity for future offending, is needed before any firm conclusions can be made (Mokros et al., 2010).

### E-Stroop

Researchers interested in child-sex offender cognitions have also utilized a modified version of the Stroop paradigm, known as the E-Stroop. As in the original Stroop paradigm, participants are required to report the color in which target words are written while ignoring any potential meaning of the word presented. However, within the E-Stroop paradigm, level of interference is compared across trials in which neutral versus emotional-salient words are presented. Previous research using this paradigm has found that salient words or images can also increase response latencies by capturing the participants’ attention and distracting them from the task at hand (e.g., Williams & Broadbent, 1986). Stimuli found to produce interference within the

E-Stroop are considered to represent processing biases held by the participant; thus, the paradigm may prove useful in identifying abnormal sexual interests among child-sex offenders.

Smith and Waterman (2004) investigated whether sex offenders demonstrated a processing bias for sex-related material using the E-Stroop. Forensic participants were classified according to the nature of their index offense (sex offender,  $n=10$ ; violent offender,  $n=10$ ; and non-violent offender,  $n=10$ ), and their response latency biases for a variety of word categories were compared to those of male community controls ( $n=13$ ). Biases were calculated by subtracting the average time taken to label ink color for neutral words from the mean response time for target categories, such as violent and sexually themed words. Results showed that both violent and sexual offenders demonstrated impaired (slower) color-labelling performance during trials containing sex-related words compared to the community controls, but that sex-offenders experienced the greatest interference (no effect sizes reported). The finding that response latency biases were increased for both these groups suggests that a sex-related processing bias is related to violent offending in general, rather than sexual offending in particular. However, the interference experienced by violent offenders may have been due to the sexual words used within this investigation having violent connotations (Smith & Waterman, 2004), raising the possibility that sex-offenders could be distinguished from violent offenders by using a more selective set of sex-related materials (but, see Price & Hanson, 2007, as mentioned later). When examining sex-offender subtypes (pedophiles convicted of indecent assault [ $n=5$ ] vs. rapists [ $n=5$ ]), response latency biases were statistically indistinguishable for sex-related materials, but a significant difference was found for violence-related trials, such that rapists demonstrated greater interference than did pedophiles ( $d=0.50$ , representing a medium effect size). That these sex-offender subtypes diverged in their response to different themes within the E-Stroop suggests it may be able to help construct a profile of stimuli that are particularly salient to a particular offender, helping interventions to target their individual pattern of sexual interest.

Within an extension of this study, Price and Hanson (2007) compared the response latency biases of rapists, child-sex offenders, violent offenders, non-violent non-sexual offenders, and community controls (all  $ns=15$ ) to sexual, violent, sexually violent, child-related, and neutral words within the E-Stroop. It was predicted that both rapists and child-sex offenders would show greater interference on sex-related trials compared to offender and community controls, that rapists alone would show interference on sexually violent trials, and that child-sex offenders alone would be impaired on child-related trials. Results showed that, for sex-related words, the only significant difference found was that rapists were

significantly slower than community controls ( $d = 1.13$ , representing a large effect size). Crucially, offender subtypes could not be distinguished in terms of their response latency biases to any of the word categories. Also, against predictions, no significant differences were found between rapists and child-sex offenders when assessing response latencies to sexually violent and child-related words. The fact that all participant groups demonstrated interference for the critical word lists suggests either that the words used were too salient to produce meaningful differences between groups (Price & Hanson, 2007) or that the E-Stroop is not able to reliably differentiate between offenders in terms of deviant processing biases. Another potential confound for the E-Stroop paradigm is that a processing bias for sexually deviant materials could result from sources other than deviant sexual interest, such as a personal history of sexual abuse. As such factors were uncontrolled for within either study, it is possible that offender controls had experiences of sexual abuse in their past that increased the salience of sexually deviant materials to them, thus reducing the level of detectable difference between groups (Price & Hanson, 2007). A personal history of sexual abuse could also provide an alternative explanation for interference observed within a given sample (Smith & Waterman, 2004). Further research controlling for such factors is needed to examine such possibilities.

In summary, the E-Stroop paradigm has some considerable improvements to make before it can be considered of use in identifying offenders with a history of sexual offenses against children. In addition to the concerns previously raised, E-Stroop paradigms have been shown to demonstrate poor reliability, especially when bias indexes are used, rather than raw response latencies. For example, Strauss and colleagues (2005) reported test-retest reliabilities ranging from just  $-.06$  to  $-.27$  across a range of emotion versus neutral bias indexes. Also, the effect sizes reported for existing significant findings remain small (the studies of Smith & Waterman, 2004, and Price & Hanson, 2007, produced averaged  $d$  values of just  $0.33$  [sexual vs. nonsexual non-violent offenders] and  $0.37$  [sexual vs. violent offenders]), suggesting other methodologies (such as the more reliable and predictive IAT or VT paradigms) may currently be of greater use.

## RSVP

Within traditional RSVP paradigms, the participant is presented with a rapid sequence of stimuli and is instructed to detect two targets within this sequence. For example, the participant may be presented with a string of single letters, one after the other, and be asked to detect the two white letters that were presented within this string of stimuli. Investigations using this procedure have found that if the second target (T2) is presented

shortly after the first target (T1), participants fail to detect its presence (Beech et al., 2008). Failure to detect T2 under such conditions is argued to be due to T1 capturing the participant's attention, leaving them without the attentional resources necessary to detect T2—a phenomenon known as an “attentional blink.” As such, the strength and duration of the attentional blink experienced by participants is considered an indicator of how much attention was captured by T1. Furthermore, the size of the attentional blink experienced is modulated by the salience of T1 to the participant. For example, emotionally or sexually salient T1 stimuli have been found to affect the accuracy with which T2 is reported (Arnell, Killman, & Fijavz, 2007; Most, Chun, Widders, & Zald, 2005). This suggests that the degree to which T2 detection is disrupted can be used as an index of attentional interest in T1. Investigations examining the reliability of the RSVP and the attentional blink phenomenon have produced favorable split-half reliabilities, generally above  $.70$  (e.g., Saint-Aubin & Klein, 2004), suggesting the paradigm can be relied on as a reliable index of attentional processes.

Beech and colleagues (2008) used this procedure to investigate whether child-sex offenders would experience greater attentional capture by images of children (T1) that would result in an enhanced attentional blink in reporting an unrelated T2. Child-sex offenders ( $n = 34$ ) and offender controls ( $n = 17$ ) were exposed to rapid presentation of a series of images and asked to report whether T1 was an animal or child and whether T2 was a chair or train facing left or right. Results showed that, whereas offender controls were less accurate at reporting T2 when T1 was an image of an animal, child-sex offenders were less accurate at reporting T2 (i.e., experienced an enhanced attentional blink) when T1 was an image of a child. Both intrafamilial and extrafamilial child-sex offenders were significantly more impaired in detecting and reporting T2 when T1 was a child than were offender controls ( $r_{\text{contrast}} = .45$  and  $.54$ , respectively, representing large effect sizes). Such results suggest that an abnormal interest in children may be indexed via an enhanced attentional blink following child-related stimuli relative to that produced by control T1 stimuli. These results were also found when participants were only required to report T2, suggesting that images of children capture the attention of child-sex offenders to a greater extent than do images of animals, even when they are not explicitly instructed to attend to them. This RSVP task also demonstrated good discriminative validity in distinguishing between the two groups of offenders, with a reported AUC of  $0.77$ .

There are, however, concerns that enhanced attentional capture by child-related stimuli could be the result of other contextual factors that would legitimately increase the salience of children to a participant without indicating deviancy. For example, groups who regularly interact with children, such as teachers or parents, may

show such an enhanced attentional blink in response to the presentation of child-related stimuli. Despite these concerns, preliminary data from Beech and colleagues (2008) indicate that even new parents demonstrate a response profile that is more characteristic of that displayed by an offender control group than that of those with a history of child molestation; however, further validation of the tool in discriminating between such groups is required.

Crooks, Rostill-Brookes, Beech, and Bickley (2009) examined whether the RSVP paradigm could likewise identify those with a history of sexual offenses against children among adolescent offenders. They presented the same procedure to adolescent sexual offenders ( $n = 20$ ) and adolescent nonsexual-offender controls ( $n = 26$ ), yet found the measure failed to discriminate between the two groups. Both groups were more likely to show an enhanced attentional blink for T2 when T1 was an animal than when T1 was a child (no effect size reported). Potential explanations as to why the RSVP task proved successful in discriminating adult child-sex offenders (Beech et al., 2008), yet failed among these adolescent offenders, include differences in their cognitive capabilities and the transient nature of sexual interest during the teenage years (Crooks et al., 2009).

In summary, paradigms examining attentional capture among child-sex offenders currently provide mixed evidence to support the idea that this offender population possesses distinct attentional biases with regards to the concepts of children and sex. This may be related to the varied reliability among the paradigms considered. For example, the CRT paradigm has evidenced strong reliability and has, thus far, produced significant differences between offender groups. In contrast, the less-reliable E-Stroop paradigm has, thus far, failed to demonstrate significant differences between offender subtypes. Further investigations using such techniques seem warranted to help clarify the situation.

## VT

VT represents another indirect means of measuring sexual interest based on attentional processes. It is based on the rationale that people will look longer at things to which they are sexually attracted. Early support for this idea was presented by Rosenzweig (1942), who found that male schizophrenic inpatients, rated by staff as presenting with more spontaneous displays of sexual behavior, looked longer at sexual slides than did those patients rated as being low in such behaviors. Further research revealed that VT measures could reliably distinguish between male participants with a heterosexual or homosexual orientation (Zamansky, 1956), demonstrating their use as indicators of sexual interest. Within VT procedures, participants are typically asked to make attractiveness ratings of, or answer innocuous questions about, a series of images while the time they take to view

each image is unobtrusively recorded. Since its validation, several studies have investigated the potential for such a procedure to replace traditional PPG as a means of detecting deviant sexual interests among child-sex offenders.

Harris, Rice, Quinsey, and Chaplin (1996) compared the ability of VT measures and PPG to discriminate between male child-sex offenders ( $n = 26$ ) and heterosexual male community controls ( $n = 25$ ). They reported that within the VT, compared to controls, child-sex offenders spent significantly longer looking at slides of children than they did at slides of adults. They also noted that a deviance index, calculated using VTs across the stimulus categories, provided strong discrimination between child-sex offenders and controls ( $d = 1.0$ , representing a large effect size), but that it did not obtain the same level of discriminatory power as the PPG measurement ( $d = 2.1$ ).

The Abel Screen (Abel, 1995) is one of the most widely used measures of VT among sex-offender populations (Snowden & Gray, 2010). Abel, Lawry, Karlstrom, Osborn, and Gillespie (1994) administered the Abel Screen to 185 adult males known to have offended against pubescent or prepubescent children, and compared their responses to 101 adult male controls. The set of slides presented contained both nude and clothed exemplars of children, adolescents, and adults. Results of discriminatory analyses revealed high sensitivity to, and specificity for, those sexually interested in pubescent boys (90% and 98%, respectively); a moderate sensitivity to, and high specificity for, those interested in prepubescent boys (76% and 98%, respectively); and a high sensitivity, but low specificity for, those interested in pubescent (86% and 77%, respectively) or prepubescent girls (91% and 77%, respectively). These results have been interpreted with caution, however, given the fact most research on the Abel Screen is conducted by the authors themselves, little information is provided to facilitate replication, and the nude images that substantially contributed to the reported classification ability have since been removed from the measure.

In 1998, Abel, Huffman, Warberg, and Holland (1998) compared the ability of the Abel Screen and PPG to correctly classify groups of child-sex offenders, defined by the gender and age (under 14 vs. 14–17) of their previous victims referred, to a community-based clinic for evaluation or treatment. Their responses were compared to an offender control group of outpatients attending the same clinic for treatment related to rape, exhibitionism, or voyeurism (no exact *ns* provided). Results demonstrated that the VT data were significantly correlated with group membership for those classified as having offended against male or female children and male adolescents, but not female adolescents (no effect sizes reported). Results demonstrated that the Abel Screen correctly classified a (nonsignificantly)

greater proportion of participants who offended against female or male adolescents and male children than did the PPG (no effect sizes reported). Such findings suggest that, for some child-sex offender groups at least, the Abel Screen may act as a suitable alternative to a PPG measurement. However, it should be noted that given differences in the number and nature of stimuli used (nudity only included in the PPG measure) and the length of exposure per image (PPG fixed duration; Abel Screen self-determined), direct comparisons are difficult to make (Abel et al., 1998). Also, Fischer and Smith (1999) raised several concerns over the lack of detail reported in Abel et al.'s (1998) findings (i.e., the authors did not disclose how child-sex offender group membership was decided, and exact correlations between VT data and group membership were not reported).

The major criticism of data relating to the Abel Screen as a measure of sexual interest is that it is predominantly based on research conducted within the authors' own lab. Letourneau (2002) provided more independent data regarding the Abel Screen using a sample of military inmates convicted of hands-on sexual offenses. Child-sex offenders (pedophilic,  $n = 56$ ; hebephilic,  $n = 11$ ) were compared to sex-offender controls (rapists,  $n = 13$ ) and classified into four sexual interest groups according to the age and gender of their previous victims. The PPG was administered using auditory stimuli depicting a variety of sexual situations, and VTs recorded for a range of corresponding images. Convergent validity analyses showed that the VT and PPG measures correlated well for all corresponding stimuli, except those related to adolescent females (reported  $r$ s ranged from .18 for adolescent females to .61 for young males, representing a range of small, medium, and large effect sizes). However, the lack of correspondence between adolescent female stimuli may have been due to the use of auditory PPG stimuli where the age of victims within simulated scenarios is less clearly specified (Letourneau, 2002). Results also showed that, although both measures accurately identified offenders with young male victims (under 14), neither demonstrated acceptable validity in identifying offenders with young female victims (under 14; no effect sizes reported). This may have been due, in part, to the use of all other offender groups as controls within such analyses. As a result, offenders with adolescent female victims (who may also have had an interest in younger girls) were included as controls when trying to identify offenders with prepubescent female victims, potentially reducing the level of detectable difference between targets and controls. Alternatively, the lack of significant findings regarding female child stimuli may be due to the child-sex offender group consisting largely of intrafamilial offenders who may be less motivated to offend due to sexual attraction to minors, but instead offend due to other factors such as opportunity (Letourneau, 2002). Despite concerns over the applicability of these

findings beyond a small military-based sample, they provide further evidence that VT measures are comparable to PPG and can successfully distinguish at least some subtypes of child-sex offenders from other sex-offender controls (namely, those with young male victims).

Cloyd (2007) conducted an improved replication of Letourneau's (2002) investigation using a larger sample of child-sex offenders taken from a more mainstream population (adult males referred to an outpatient clinic for evaluation and treatment of sexual-offending behaviors;  $n = 96$ ). That study also had the advantage of using a more standardized PPG measure (Monarch 21) and an alternative form of VT assessment (Affinity; Glasgow, Osborne, & Croxson, 2003). Correlational analyses revealed that the two measures were "at least somewhat comparable" with four categories reaching statistical significance and a further 10 demonstrating a trend toward significance. The overall deviance indexes calculated for PPG and VT measures were also significantly correlated, yet the effect size for this relationship remained small ( $r = .20$ ). Cloyd concluded that, on the basis of current data, PPG and VT instruments do not demonstrate strong enough associations to assume psychological equivalency. This could mean that VT measures are (a) simply less accurate than traditional PPG and should not be considered a valid replacement for them in identifying deviant sexual interests, or (b) that the two measures index slightly different concepts that would provide complementary information in the assessment of sex offenders. Further research comparing the convergent and predictive validity of both tools is required to distinguish between these possibilities.

In summary, data comparing PPG and VT measures suggests that, at least in some child-sex offender subgroups (such as those with male victims), VT measures may provide a valid means of indirectly assessing deviant sexual interest in children. Other studies have compared the performance of VT measures to other indirect indexes of sexual interest, such as a card-sort procedure and the IAT paradigm.

Gress (2005) compared the ability of VT and a card-sort procedure to identify the age and gender of past victims in a group of adult males convicted of hands-on sexual offenses and referred to an outpatient clinic for treatment (child-sex offender,  $n = 19$ ; rapist,  $n = 7$ ). Participants were asked to make subjective judgments (e.g., "Would you like to have sex with the person in the picture?") about a series of images depicting clothed and nude images of males and females aged 5, 9, 13, and "adult" while their VT was unobtrusively measured. These images were computer-generated and of a non-explicit nature. Participants also completed the Sexual Deviance Card Sort, which requires the person to rate the attractiveness of different types of sexual behaviors, and has shown comparable classification ability among sex-offender populations to the PPG



(Laws, Hanson, Osborn, & Greenbaum, 2000). Results showed that, whereas the card-sort procedure demonstrated superior ability to identify offenders with adult victims (the card sort demonstrated 100% accuracy, and the VT measure demonstrated only 57%), the VT measure was superior in identifying those with child victims (the VT measure demonstrated 84% accuracy, while the card sort correctly identified just 16% of participants). The VT measure also outperformed the card sort in identifying offender gender preferences, especially in identifying those offenders with mixed male and female interests (the card sort incorrectly classified 77% of this mixed interest group as having an exclusive interest in females). Given the small sample size, inferential statistics were not conducted, meaning the results do not demonstrate whether offenders with child or adult victims can be differentiated on the basis of VT alone. This study was also limited by its lack of a control group.

Banse and colleagues (2010) compared the discriminative validity of VT and IAT techniques within the EISIP battery of assessments and found VT measures to be superior, with particularly high AUCs reported for responses to images of men or boys in identifying those with prior offenses against children of either gender, compared to other offender controls (AUCs for each of the raw VT scores ranged from 0.56–0.82, representing a range of small, medium, and large effect sizes). During criterion validity analyses, however, the overall children versus adults VT scores failed to discriminate between child-sex offenders and any controls (AUC of just 0.51). Also, no significant differences were reported between VT responses for offenders with female-only and mixed victims (no reported effect sizes). These data suggest that, although VT measures demonstrate the ability to differentiate some subtypes of sexual offenders, their criterion and discriminative validity currently remain below optimal.

The aforementioned evidence seems to indicate that VT measures possess some ability to distinguish some adult child-sex offenders on the basis of the gender and age of their previous victims. However, given empirical data suggesting that deviant sexual interests contribute to just 25% to 36% of adolescent sex offenses, and that other factors such as antisociality and intimacy deficits likely play a role, concerns have been raised regarding the validity of VT measures in younger sex offenders (Worling, 2006). These concerns seem to be justified given initial data collected using VT measures to classify adolescent sex offenders on the basis of previous offending behavior. For example, Abel et al. (2004) examined the ability of the Abel Assessment for Sexual Interest (AASI) to distinguish adolescents who admit to having molested a child (at least five years younger than themselves) from adolescent controls, using a database of all adolescent clients who had completed the AASI as part of treatment or evaluation

between 1994 and 2003 (molesters,  $n = 1,170$ ; controls,  $n = 534$ ). They reported favorable findings that the VT measure could accurately distinguish between molesting and non-molesting adolescents, such that participants with a history of sexual offending against children looked at child-related images for a significantly longer duration of time ( $AUC = 0.64$ , representing a medium effect size). Furthermore, they also reported that the length of time spent looking at child-related images was positively correlated with the number of reported victims, suggesting longer viewing is associated with more frequent offending or greater sexual deviance ( $r = .18$ , representing a small effect size).

Despite such promising results, the reported AUC was just 0.64, falling below the range considered indicative of acceptable discrimination (0.7–0.8; Hosmer & Lemeshow, 2000), forcing Abel and colleagues (2004) to conclude that the AASI cannot independently identify deviant sexual behaviors and should only be used alongside other, more-validated measures within adolescent populations. This study was also limited by its exclusive use of adolescents who admitted to molesting children, meaning the AASI may not be able to identify deviant sexual interest among those who deny such behaviors and are more motivated to dissimulate.

Worling (2006) also investigated the ability of a VT measure (Affinity) to distinguish between adolescents who admitted molesting children ( $n = 52$ ) and non-molesting adolescents ( $n = 26$ , defined as admitting to sexual assaults against peers or adults only) based at residential or community treatment centers. Overall, a significant correlation was found between recorded Affinity VTs and self-reported Affinity attractiveness ratings across image categories ( $r = .31$ , representing a medium effect size). However, a significant, negative correlation was reported between VT and self-reported attraction to adult females, suggesting those who were more strongly attracted to adult females made their ratings more quickly—a finding that runs counter to the rationale behind VT measures entirely ( $r = -.26$ , representing a medium effect size). Worling provided several potential explanations for such a counterintuitive result, such as the adolescents exaggerating their attraction to adult females in an attempt to seem less deviant or there existing an inverted U-shaped relationship between sexual attraction and rating speed (i.e., fastest to rate those both highly attractive and highly unattractive to ourselves). However, these interpretations remain speculative and require further investigation.

Discriminative validity analyses revealed that, whereas the self-reported attraction ratings were able to distinguish adolescents with any child victim ( $AUC = 0.67$ , representing a medium effect size), VT was only able to significantly discriminate those with male victims from other offender controls ( $AUC = 0.69$ , 0.69, representing a medium effect size). However, the finding that offenders with young female victims fail to

demonstrate an enhanced attraction to female children during implicit measures has been reported in other VT and PPG investigations among adult sex-offender populations (e.g., Letourneau, 2002), suggesting Affinity may not necessarily suffer from reduced validity among adolescent populations. Again, however, reported AUCs were relatively low (the highest being 0.73 for offending exclusively against males), demonstrating that VT measures require substantial improvements before they can be used to identify deviant sexual interests among adolescent populations (Worling, 2006).

In summary, as an indirect measure of deviant sexual interest, VT has shown some promise among sex-offender populations (e.g., Abel et al., 1998; Harris et al., 1996). In addition, VT paradigms have generally demonstrated acceptable to strong internal reliability in both adult and adolescent populations (stimulus category alpha ranging from .60–.90; e.g., Letourneau, 2002; Worling, 2006). However, its discriminative ability still lags behind that reported for more established measures such as PPG, and reported findings are often limited by a lack of appropriate control groups or sample sizes to detect meaningful differences. In addition, VT research has focused (almost) exclusively on male child-sex offenders, meaning its applicability to female offenders remains unknown (Worling, 2006).

### Conclusion

The indirect measurement of cognitions appears to hold a great deal of promise in the domain of sexual offending against children. A recent explosion of studies has shown these methods can be used to distinguish between known groups, such as those with a conviction for child-sex offenses and those without such a conviction. The accuracy for some of these instruments appears at least equal to, if not exceeding, those that have been previously employed in the clinical domain such as PPG, and combining such indirect techniques into a battery may well exceed even the performance of any single such test (Banse et al., 2010).

This simple demonstration at the group accuracy level has led to further experimentation that uses indirect measurement to test theories of sexual offending. The notion that male child-sex offenders may hold some distorted cognitions has been tested using a variety of indirect techniques, with some notions appearing to be supported (e.g., children as sexy), whereas others have not been supported. It is notable that where this has been tested, this distorted cognition, as measured by indirect techniques, is apparent even in those child-sex offenders who deny or minimize this at an explicit level (Brown et al., 2009). The question of whether female sex-offenders also hold distorted cognitions has also been addressed, and the tentative answer appears to be that they do not hold the same distortions as male

child-sex offenders (e.g., children as sexy). The relevance of these findings to management and treatment is huge and obvious.

In this review, we have covered a large number of indirect measurement techniques, and we wish to give recommendations to others who wish to use and do research with them (e.g., which is the “best,” etc.). Unfortunately, deriving such a league table of techniques is not a simple business. For a start, there exist several different criteria as to what constitutes a “good” measure of cognition (e.g., predictive validity, construct validity, reliability, etc.); and, whereas certain measures may be strong in one of these, they may lack credibility in another. Nonetheless, Tables 1 and 2 attempt to present each of these reviewed studies according to one such criterion; effect size. Table 1 displays effect sizes representing the magnitude of differences observed between certain participant groups. Where studies contain more than two participant groups, clarification is provided as to which group comparison the reported effect size refers. In addition, Table 2 displays the magnitude of correlations reported between VT and PPG measures. These effect sizes are displayed separately, as they reflect the degree of association between two measures, whereas the effect sizes presented in Table 1 pertain to the magnitude of reported group differences.

As can be seen, various different effect sizes have been reported within the studies reviewed. In an attempt to standardize presentation and to increase comparability, Cohen’s *d* equivalents have been calculated wherever possible. In some cases, effect sizes were not reported within the original report. Wherever possible, *d* values have been calculated for these studies using the information available to us. Despite presenting results from various reports within a common effect size language, such tables fall far short of solving the question of which indirect measure is best. First, the different techniques have addressed different questions and have used different populations, making their findings immediately less comparable. To truly compare and rank different indirect measures accordingly, they would need to be used to answer the same research question using the same participant sample. Until such an endeavour is made, the contents of such a table remain purely illustrative. Also, additional concerns such as ease of administration, ability for repeat administration, ability to fake the test, and ease of interpretation may also influence the decision as to which indirect measure to utilize within a particular study.

Measures based on the manipulation of relevant or irrelevant SRC currently provide strong evidence that child-sex offenders can be distinguished on the basis of indirectly measured cognitions. The evidence for the IAT appears, perhaps, the strongest, with a large number of replications, at least for the notion of an association between the concepts of child and sex (e.g., Gray et al., 2005). The IAT appears to be a very promising

Table 1. Original Reported Effect Sizes and Cohen's *d* Equivalents for Group Differences Discussed in the Review

SRC Type	Measure	Study	Sample Type ( <i>n</i> )	Specific Test	Sub-Sample Compared	Effect Size Reported	Cohen's <i>d</i> Equivalent			
Relevant/ irrelevant S-R	IAT	Gray, Brown, MacCulloch, Smith, & Snowden (2005) Brown, Gray, & Snowden (2009)	MCSO (18) and OC (60)	Child-Sex IAT		$d = 0.84$	0.84**			
			Pedophilic MCSO (54), hebephilic MCSO (21), and NSOC (49)	Child-Sex IAT	Pedophilic MCSO vs. hebephilic MCSO	$d = 0.77$	0.77**			
			Admitting pedophilic MCSO (20), denying pedophilic MCSO (55), and NSOC (49)	Child-Sex IAT	Pedophilic MCSO vs. OC Admitting pedophilic MCSO vs. NSOC Denying pedophilic MCSO vs. NSOC	$d = 0.92$ $d = 0.75$ $d = 1.01$	0.92*** 0.75* 1.01**			
		Mihalides, Devilly, & Ward (2004)			MCSO (25), male NSNVOC (25), male CC (25), and female CC (25)	Children as sexual beings IAT	MCSO vs. NSNVOC MCSO vs. Male CC MCSO vs. Female CC	$d = 0.63$ $d = 0.92$ $d = 0.97$	0.63** 0.92*** 0.97***	
						Controllability of sexuality IAT	MCSO vs. NSNVOC MCSO vs. male CC MCSO vs. female CC	$d = 0.58$ $d = 0.97$ $d = 0.90$	0.58** 0.97*** 0.90***	
						Sexual entitlement IAT	MCSO vs. NSNVOC MCSO vs. male CC MCSO vs. female CC	$d = 0.35$ $d = 0.84$ $d = 0.89$	0.35 0.84** 0.89***	
						Sexy-child IAT		$r = .33$	0.71*	
						Powerful-child IAT		$r = .08$	0.17	
						Pleasant-child IAT		$r = .21$	0.44	
						Sexy-self IAT		$r = -.16$	-0.33	
	Powerful-self IAT					$r = .02$	0.04			
	Pleasant-self IAT					$r = .19$	0.40			
	Child-erotic IAT					None reported $R_p^2 = .23$	— 1.09*			
Nunes, Firestone, & Baldwin (2007)			MCSO (27) and NSOC (29)	Humiliation-erotic IAT Child-erotic IAT	Offenders vs. male CC Primary MCSO vs. intermediates Offenders vs. male CC	None reported $R_p^2 = .19$	— 0.96*			
				Primary pedophiles (17), primary rapists (21), intermediates (8), and male CC (47)						
				Offenders in danger of relapse (17) and offenders not in danger of relapse (16)						
				MCSO (38), NSOC (37), and male CC (38)	Boys-men IAT Girls-women IAT Children-adult IAT Child-sex IAT	MCSO vs. all controls MCSO vs. all controls MCSO vs. all controls	AUC=0.62 AUC=0.72 AUC=0.71 AUC=0.89	0.44 0.83* 0.67* 1.74***		
				Community-based pedophiles (20) and male CC (20)	Child-sex IAT					
				FCSO (17) and female OC (17)	Child-sex IAT			None reported	—	
			Steffens, Yundina, & Panning (2008)							
			Banse, Schmidt, & Clarbour (2010)							
Van Leeuwen et al. (in preparation) Gannon, Rose, & Williams (2009)										

Relevant S-R	IRAP	Dawson, Barnes-Holmes, Gresswell, Hart, & Gore (2010)	Community-based MCSO (16) and male CC (16)	Child-sexual IRAP	$\eta_p^2 = 0.17$	0.91*
S-S compatibility	LDPT	Keown, Gannon, & Ward (2008b)	MCSO (32), OC (31), and male CC (31)	Overall Children as sexual beings Dangerous world Entitlement Nature of harm Uncontrollability	$\eta^2 = 0.04$ $\eta^2 = 0.01$	0.41 0.11
				All groups All groups	$\eta^2 = 0.04$ $\eta^2 = 0.01$ $\eta^2 = 0.03$ $\eta^2 = 0.08$	0.41 0.09 0.35 0.60*
				MCSO vs. OC MCSO vs. CC MCSO vs. NSOC MCSO vs. male CC MCSO vs. NSOC MCSO vs. male CC	None reported None reported None reported None reported None reported None reported AUC = 0.84	— — — — — — 1.41**
Irrelevant S-R/ S-S compatibility No SRC	Picture-word Stroop CRT	Kamphuis, De Ruiter, Janssen, & Spiering (2005)	MCSO (10), NSOC (15), and male CC (20)	Sex-to-power Power-to-sex		— —
		Van Leeuwen et al. (in preparation)	Community-based pedophiles (20) and male CC (20)	Child vs. adult images		—
		Girotakis (2006)	MCSO (27), rapist (31), male CC (53), and female CC (24)	Child vs. adult images		—
		Mokros, Dombert, Osterheider, Zappalà, & Santtila (2010)	MCSO (21) and NSOC (21)	Child vs. adult images	$\eta_p^2 = 0.11$	0.76**
	E-Stroop	Smith & Waterman (2004)	SO (10), NSOC (10), NSNVOC (10), and male CC (13)	Sexual vs. neutral words		—
			Rapist (5) and pedophile (5)	Sexual vs. neutral words		—
			Rapist (5) and pedophile (5)	Violence vs. neutral words		0.50 1.22*
		Price & Hanson (2007)	MCSO (15), rapist (15), NSOC (15), NSNVOC (15), and male CC (15)	Sexual vs. neutral words		—0.45 —0.03 0.14 0.82 1.13*
				Sexually violent vs. neutral words		—0.28 0.20
		Averaged E-Stroop studies	SO (40), NSOC (25), and NSNVOC (25)	Sexual vs. neutral words	$d = 0.33$	0.33
	RSVP	Beech et al. (2008)	IF MCSO (16), EF MCSO (18), and NSOC (17)	T1 child vs. animal	$d = 0.37$	0.37
		Crooks, Rostill-Brookes, Beech, & Bickley (2009)	Adolescent MCSO (20) and adolescent NSOC (26)	T1 child vs. animal	$r_{\text{contrast}} = .45$ $r_{\text{contrast}} = .54$	1.03** 1.30***
				None reported		—

(Continued)

Table 1. Continued

SRC Type	Measure	Study	Sample Type (n)	Specific Test	Sub-Sample Compared	Effect Size Reported	Cohen's <i>d</i> Equivalent
VT		Harris, Rice, Quinsey, & Chaplin (1996)	MCSO (26) and male CC (25)	Adult vs. child images		<i>d</i> = 1.00	1.00
		Abel, Lawry, Karlstrom, Osborn, & Gillespie (1994)	MCSO (185) and male CC (101)	Adult vs. child images		None reported	—
		Abel, Huffman, Warberg, & Holland (1998)	MCSO and SOC (no exact <i>ns</i> specified)	Adult vs. child images		None reported	—
		Letourneau (2002)	Pedophilic MCSO (56), hebephilic MCSO (11), and rapists (13)	Adult vs. child images	MCSO vs. rapist	None reported	—
		Gress (2005)	Community-based MCSO (19) and rapists (7)	Adult vs. child images		None reported	—
		Banase et al. (2010)	MCSO (38), NSOC (37), and male CC (38)	Boy images Adult men images Girl images	MCSO vs. all controls MCSO vs. all controls MCSO vs. all controls	AUC = 0.80 AUC = 0.82 AUC = 0.76	1.20* 1.30* 1.00*
		Abel et al. (2004)	Adolescent admitting MCSO (1,170) and adolescent controls (534)	Overall children vs. adult images Adult vs. child images	MCSO vs. all controls MCSO vs. all controls	AUC = 0.56 AUC = 0.51	0.21 0.04
		Worling (2006)	Community-based adolescent admitting MCSO (52) and adolescent peer-offender controls (26)	Adult vs. child images	Any child victim	AUC = 0.61	0.40
			Any male victim			AUC = 0.69	0.71**

*Note.* SRC = stimulus response compatibility; S-R = stimulus-response; IAT = Implicit Association Test; MCSO = male child sex offender; OC = offender control; NSOC = non-sex offender control; NSNVOC = non-sex non-violent offender control; CC = community control; AUC = Area Under Curve; FCSO = female child sex offender; IRAP = Implicit Relational Assessment Procedure; S = stimulus-stimulus; LDPT = Lexical Decision Priming Task; CRT = choice reaction time; SO = sex offender; E-Stroop = Emotional Stroop; RSVP = Rapid Serial Visual Presentation; VT = viewing time; IF = intrafamilial; EF = extrafamilial; T1 = first target; SOC = sex-offender controls. . .

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

**Table 2.** Original Reported Effect Sizes and Cohen's *d* Equivalents for Correlations between VT and PPG Measures

Study	Sample Type ( <i>n</i> )	Specific Test	Sub-Sample Compared	Effect Size Reported	Cohen's <i>d</i> Equivalent
Letourneau (2002)	Pedophilic MCSO (56), hebephilic MCSO (11), and rapists (13)	Adult vs. child images	Young female stimuli PPG-VT correlation	$r = .28$	0.59*
			Young male stimuli PPG-VT correlation	$r = .61$	1.56**
Cloyd (2007)	Community-based MCSO (96)	Adult vs. child images	Adolescent female stimuli PPG-VT correlation	$r = .18$	0.37
			Adolescent male stimuli PPG-VT correlation	$r = .38$	0.83*
			PPG and VT deviance index correlation	$r = .20$	0.41*
			Number of victims-VT correlation	$r = .18$	0.37***
Abel et al. (2004)	Adolescent admitting MCSO (1,170) and adolescent controls (534)	Adult vs. child images	Overall self-reported attraction-VT correlation	$r = .31$	0.67**
Worling (2006)	Community-based adolescent admitting MCSO (52) and adolescent peer-offender controls (26)	Adult vs. child images	Adult female self-reported attraction-VT correlation	$r = -.26$	-0.55

Note. VT = viewing time; PPG = penile plethysmography; MCSO = male child sex offender.  
\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

tool in that it can be easily adapted to explore specific cognitions (e.g., children as vulnerable), and can even incorporate ideographic information. On the downside, however, this technique works at the category level, rather than at the specific exemplar level, which limits the specificity of the information to this category level. Recent variations on the IAT technique, such as the IRAP, also show much promise.

Measures manipulating both irrelevant SRC and S-S compatibility also appear to hold promise within the domain of child-sex offender cognition. A recent report using a variation of the traditional Stroop paradigm, which appears more akin to a simultaneous priming paradigm, was able to distinguish between those with and without a sexual attraction to children with impressive accuracy (van Leeuwen et al., 2009). However, this result represents a single study using a small and unusual sample (self-professed pedophiles living within the community), meaning replication is necessary before strong conclusions regarding child-sex offender cognition can be made on the basis of this paradigm.

Indirect techniques manipulating purely S-S compatibility (e.g., LDPT) have proven less successful in differentiating known child-sex offenders from controls. By priming a particular concept, researchers have hoped to access distorted cognitions in sex offenders. However, so far, the results have not yielded convincing demonstrations of the utility of this technique (although there are some promising glimpses). Despite these disappointing results, the technique appears to have the sophistication to present, and therefore measure, very complex cognitive concepts that other techniques may not be able to represent. As such, we would encourage further development and research into this (and related) technique, as they may be able to tap areas that other implicit measures do not.

Other indirect measures of cognition that do not rely on any type of SRC manipulation—but, rather, operate in terms of attentional capture—have also proven useful in the indirect study of child-sex offender cognition. Evidence from VT tasks appears strongest, with some hints that this technique may be the most accurate single measure for merely distinguishing known groups (e.g., Banse et al., 2010). Hence, it holds much promise, particularly as it can be adapted to examine very specific stimuli (e.g., images of male children under the age of six) and, hence, may give insight into the exact nature of the offenders' sexual preferences. On the downside, however, it cannot be adapted to look at other types of cognitive distortion.

The success of VT paradigms has led to variations on this theme. The CRT paradigm assumes that a person's sexual interest means that they will be distracted by such images and, thus, be slower spotting a superimposed target. The RSVP paradigm assumes that when an interesting target occurs (such as one with sexually attractive content), attention will be given to this target and a later target will be missed. Both techniques have been used; and, although evidence is extremely limited, the results,

once again, suggest great promise. These techniques may be particularly promising, as they appear to tap "automatic" processes that may be immune to the deliberate attempts to fake such tasks. However, direct tests of these ideas are needed. In contrast, the E-Stroop, which relies on similar ideas of attracting attention to a competing stimulus, has not yet provided convincing evidence for its use in child-sex offenders.

### Limitations of Indirect Techniques

First, just because a particular bias or inferred belief is revealed via an indirect measurement, it does not follow that any particular behavior is inevitable. For instance, if an IAT reveals that a person has a child-sex association, this does not mean that they would ever act on this. Models, such as that of Finkelhor (1984), note that several stages must be overcome by the individual before the criminal act takes place. Likewise, programs devised to stop sex offenders from re-offending can target these other stages to reduce offenses.

Second, any cognitions revealed via indirect measurement are not immutable. For instance, Teachman and Woody (2003) showed that phobias measured via the IAT technique can be reduced via psychological therapy, and this reduction in the IAT phobia score is accompanied by a change in the behavior of the individual to the phobia-inducing object. Clearly, this demonstration of change being indexed via an indirect measurement technique is an obvious next step for those of us interested in the use of indirect measurements in the forensic domain (Snowden & Gray, 2010).

Third, these cognitions related to sex and sexual stimuli revealed via indirect measurement are not the same as sexual arousal (Diamond, 2003; Prause, Janssen, & Hetrick, 2008). This raises the question of, "What is the relationship between something such as a child-sex implicit cognition and sexual arousal to children (as, say, indexed via PPG measurements)?" Preliminary evidence (Thornton, McKee, & Ciarda, 2009) suggests very little correlation between these measures. Hence, it would appear that they are tapping quite distinct processes related to sex offending. Both may provide areas for possible therapeutic intervention.

Indirect measurement of sex-related cognitions and processes is still in its early infancy, yet we hope this review has highlighted the tremendous potential the techniques have for both those aiming to understand the aetiology and maintenance of sex offending and for those engaged in the treatment and management of such offenders. Parallel research looking at sexual preferences in non-forensic populations (e.g., Snowden et al., 2008) also provides a test-bed for techniques and theories. We expect that the next time someone aims to review the field of indirectly measured cognitions and sex offending, their task will be far more onerous than ours.

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