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## Running head: *KEDS MEASURE*

### The Kids' Empathic Development Scale (KEDS): A Multi-Dimensional Measure of Empathy in Primary School Aged Children

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Running Head: KEDS MEASURE

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Empathy in Primary School Aged Children

### **Abstract**

Empathy is an essential building block for successful interpersonal relationships. Atypical empathic development is implicated in a range of developmental psychopathologies. However, assessment of empathy in children is constrained by a lack of suitable measurement instruments. This paper outlines the development of the Kids' Empathic Development Scale (KEDS) designed to assess some of the core affective, cognitive and behavioural components of empathy concurrently. The KEDS assesses responses to picture scenarios depicting a range of individual and interpersonal situations differing in social complexity. Results from 220 children indicate the KEDS measures three related but distinct aspects of empathy that are also related to existing measures of empathy and cognitive development. Scores on the KEDS show age and some gender related differences in the expected direction.

Keywords: Empathy, psychometrics, prosocial, development, neuroscience

## The Kids' Empathic Development Scale (KEDS): A Multi-Dimensional Measure of Empathy in Primary School Aged Children

Unprecedented neuroscientific interest in the study of empathic development has transformed measurement of the construct and at the same time, catalysed renewed debate about the nature of empathy (Coplan, 2011). Parallel clinical interest in the topic is perhaps unsurprising given that empathy has increasingly been implicated in antisocial activities such as bullying and bystander behaviour (Cappadocia et al., 2012; Gini et al., 2007) as well as a range of psychopathologies including autism, conduct disorders, personality disorders and psychopathy (Farrington & Jolliffe, 2001; Schwenck et al., 2012). Early intervention in such cases is considered a priority. Empathic ability is taken to play an essential part in understanding social interactions and is considered a necessary prerequisite both for regulating one's own behaviour and behaving prosocially or adaptively in response to others (Belacchi & Farina, 2012; Coplan, 2011). It is influential in determining an individual's acceptance by peers (Braza et al., 2009) and in the acquisition of morality (Decety, Michalska & Kinzler, 2011; Eisenberg, 2000), both are important foundations for successful social maturation. It is in the paediatric domain then, that there is increasing pressure to better measure individual differences in empathic development to facilitate early intervention in cases where empathic ability is wanting (Belacchi & Farina, 2012).

The measurement of empathy has had a lengthy history and the measurement of empathic development in children has proven especially difficult (Dadds et al., 2008; Farrington & Jolliffe, 2001; Lovett & Sheffield, 2007). In this paper we highlight several conceptual challenges surrounding both the construct of empathy and its measurement,

before introducing a newly developed multi-dimensional measure of empathic ability in children.

### **Conceptualising Empathy**

It is generally agreed that the term empathy describes the ability to put oneself in the mind of another person (Davis, 1980, 1983). Most definitions of empathy incorporate at least two fundamental elements: affective and cognitive. The term affective empathy is generally used to refer to having an affective response congruent with that of another's emotional state; and cognitive empathy refers to the ability to understand intellectually the perspective of another person and, in so doing, understand another's emotional state (M. Davis, 1980, 1983; Eisenberg & Strayer, 1987). However, here is where the agreement ends. Some researchers, for example, believe that affective empathy is primarily a process of emotional contagion (e.g. Nummenmaa et al., 2008) while others argue that this bottom up, low level process is neither necessary nor sufficient for empathy which is conceptualised as a higher order (Singer and Lamm, 2009), dynamic, effortful and motivated process (Coplan, 2011). Recent lesion studies have also suggested that there is a double dissociation in which some patients more susceptible to emotional contagion are less, rather than more, capable of empathy (Shamay-Tsoory et al., 2009). Sebastian et al., (2011) argue that there is a critical perspective taking element that is integral to both affective and cognitive theory of mind and that this is likely to be related to different aspects of empathy. They report fMRI studies that show that affective more than cognitive perspective taking recruits medial/ventromedial brain circuits that mediate the regulation of affect (Decety & Sommerville, 2003; Sebastian et al., 2011). Hence, affective perspective-taking may be an alternate pathway to operationalizing affective

empathy, still defined as ‘affective congruence’. This brief summary provides but one illustration of some of the current debates and deliberation over what exactly constitutes affective and cognitive empathy (Blair, 2005; Coplan, 2011).

An empathic response is also held to involve not only understanding the feelings of another but also being appropriately responsive; for example, feeling compassion and behaving compassionately in response to another’s suffering (Cappadocia et al., 2012). This ‘behavioural’ component of empathy is often an implicit aspect of its conceptualisation, and is based on an underlying assumption that there is a direct relationship between emotional attunement, interpersonal responsiveness and/or adaptive behaviours. Prosocial behaviour is often taken as an index of empathy yet growing evidence from the field of psychopathy suggests that cognitive empathy can exist in the absence of affective or behavioural empathy (Blair, 2005). Others go further in suggesting that successful manipulative actions toward others rely upon empathic expertise in the absence of a moral compulsion to respond in a compassionate way (Belacchi & Farina, 2012; Blair, 2005; Sutton, Smith, & Swettenham, 1999).

Hence, the utility of a conceptually differentiable measure of empathy is clear yet there is no current measure that captures all three components. All capture either cognitive empathy or affective empathy and/or the prosocial or socially adaptive behaviours that are thought to reflect empathy rather than considering these three components in concert.

### **Measuring Empathy**



While the lack of comprehensive measure is in itself a significant problem, there are additional problems with current measurement approaches, which make much previous research difficult to interpret (Blair, 2005). Four common methods of measuring affective, cognitive or behavioural empathy in children have been described by Miller and Eisenberg (1988) as each having their own limitations. These methods include:

(i) the perception of emotions portrayed through stories, pictures, audio or film.

However, simple emotion recognition or identification measures do not give an estimation of an individual's likely cognitive understanding or responsiveness to an empathy-inducing scenario. Conversely, we know that young infants and young children show responsiveness to the emotions of others before developing the ability to express or define an emotion lexicon.

(ii) picture or story-based scenarios that are interpreted by a child via self-report or interview. A difficulty with the use of visual scenarios has been the simplicity of the stimulus situation. While most real-life social and interpersonal situations are complex, dynamic and involve multiple players, most test scenarios rely on very simple two-person interactions.

(iii) self- or other-report questionnaires of empathy behaviours and characteristics remain the most common technique for assessing the behavioural products or perceived behavioural products of empathising ability in both adult and developing populations. Observer expectancy and bias, the lack of a normative basis of comparison for teachers, parents or peers, and biases in the reporting of positive or negative emotionality have all been cited as weaknesses of the parent- or other-report methods (Hayden, Klein, & Durbin, 2005). For example, research examining empathy in older children has found

that self-reports of empathic abilities and performance on picture-story interview do not necessarily converge with a child's display of prosocial behaviour (Eisenberg & Fabes, 1990).

At a more fundamental level is the developmental issue of both receptive and expressive language. When verbal scenario descriptions are used with young children it is not always clear how much of the story is understood at a literal level. Further, there are significant constraints on the extent to which children are able to verbalise and comment upon cognitive, affective or behavioural processes.

(iv) experiments that induce and then measure physiological responses, and measurements of elicited facial or gestural reactions to emotional depictions. In more recent times, neurophysiological techniques such as fMRI have also been introduced to this field (Shamay-Tsoory, 2011). The measurement of physiological responses to empathy-eliciting stimuli avoids many of the issues outlined above, however, problems still arise when trying to disentangle or distinguish between physiological responses for empathy, sympathy and distress as there is little observable physiological distinction between them. Cost, relative invasiveness and lack of portability are also prohibitive for application of physiological measures in clinical diagnostic settings.

In sum, it remains the case that there is no comprehensive measure of the multidimensional construct of empathy that is suited to use with young school-aged children. The current study introduces a new multi-dimensional measure that assesses cognitive, affective and behavioural components of empathy by combining and conceptually extending three of the techniques outlined by Miller and Eisenberg (1988):

emotion recognition, picture based scenarios and behavioural self-report. The Kids' Empathy Development Scale (KEDS) extends these methodologies by:

(i) using affective inference rather than emotion recognition as a measure of affective empathy. By removing the facial features of targets in each picture scenario it is intended to move children beyond emotional contagion, mimicry, or a cognitive appraisal of affect into a more experiential process of affective perspective-taking (Sebastian et al., 2012). Inference requires 'imagining or inferring what the other person is feeling based on various non emotional and situational cues and by putting oneself in the other's place' (Vaish, Carpenter & Tomasello, 2009, p.534). In sum, it requires a degree of affective congruence and *active* situational interpretation in a way that emotion recognition does not. Whether this constitutes a cognitive or affective form of empathy then becomes an empirical question to be evaluated by exploring the relationship between this and other measures of cognitive and affective empathy. Notably however, Sebastian et al., (2011) found that affective perspective taking in pictographic interpretation recruited additional emotion-related neural circuits than those recruited in cognitive perspective taking alone;

(ii) achieving a more comprehensive measure of both cognitive and behavioural empathy by eliciting situation description as well as multiple person-perspectives (e.g. victim and protagonist in the same scenario) within increasingly complex visual scenarios. This is intended to allow richer evaluation of the depth, breadth and inter-relatedness of understanding of situations, beliefs and actions. Historically, for example, there has been a strong focus on evaluating prosocial behaviour in relation to scenarios involving the primary protagonist in a bullying context. More recently there has been growing appreciation that the same empathic processes may be in operation for victims

and bystanders as well as protagonists and that understanding these common underlying processes may assist us to better interpret both positive and negative behavioural outcomes in a broader range of situations. Cappadocia, et al., (2012) have argued that understanding protagonist as well as understanding bystander behaviour affords differentiation of empathy-deficit pathways of poor social information processing, poor social self-efficacy and intention to prioritise personal gain over harm to others. Rudolph, et al., (2011) also explored children's responses to peer aggression (physical attack to social exclusion) with a broader conceptualisation of socially adaptive behaviours focussing on the difference between a social goal orientation of developing competence (improving social skills and relationships eg learning how to be a good friend) versus demonstrating competence (improving social judgement eg 'I am cool and not a loser'), with the former being associated with more prosocial behaviour, better emotional regulation and also broader social adaptive functioning. So, exploring more complex situations from multiple perspectives with conceptualisations of adaptive behaviour that go beyond prosocial behaviour may enrich our conceptualisation of empathy.

Using these methods concurrently with the same sample of children in relation to the same scenario, makes it possible to more closely examine the relationship between data elicited in different ways. In measuring a consolidated multi-dimensional empathy construct, multiple measurement methods balance the limitations of each method when utilised alone.

The psychometric properties of the KEDS scale will be examined here and of particular interest is the validity of three possible subscale scores reflecting cognitive, affective and behavioural aspects of empathy. The internal consistency of these subscales

(cognitive, affective and behavioural) will be examined and the concurrent validity of the KEDS against a number of current empathy tasks. The possibility of confounds with verbal ability will be explored as will confounds with cognitive ability and executive functions more generally. In examining its utility with paediatric samples, gender and developmental differences in KEDS performance will also be explored as will differences in response to scenarios of increasing social complexity.

## **Method**

### **Participants**

Participants included 220 typically developing children from almost seven years to ten years of age (6.98 – 10.75 years; 115 males). Children all attended Project K.I.D.S. (Kids Intellectual Development Study) held at the Neurocognitive Development Unit at the University of Western Australia (Anderson, Reid & Nelson, 2001) during the school holidays of July 2007 (n = 114) or July 2008 (n = 106). Participant numbers vary in different analyses due to incomplete data sets. These are described in the relevant tables.

During the initial phase of recruitment, information packs were distributed to families in grades two to five of local primary schools in the Perth Metropolitan area, in Western Australia. After interested parents completed and returned registration and consent forms they were contacted again by phone and invited to participate.

### **Materials and Procedure**

**The Kids' Empathic Development Scale (KEDS)** is a measure of complex emotion and mental state comprehension as well as a behavioural measure of empathy. The test was originally designed with the intention that it:

- i. Was accessible and relevant to young primary school aged children, from seven years of age;
- ii. Sequentially assessed cognitive, affective and behavioural elements of empathy in response to the same scenarios;
- iii. Utilised visual scenarios rather than stories in recognition of the limited receptive language skills of young children;
- iv. Induced affective inference by using figures without faces (i.e., blank space instead of a face) rather than being limited to emotion recognition; Subsequently, after ascertaining affective inference and cognitive understanding of the scenario, asked the child what they would do 'if they were that boy/girl' to assess behavioural empathy.
- v. Utilised visual emotion identification response cards in the form of animated faces and adopted a standardised questioning and prompting system in recognition of the limitations in expressive language of young children;
- vi. Incorporated both simple (happy, sad, angry) and complex (relaxed, surprised, afraid) emotion choices in keeping with an individual differences approach and based on the literature on emotion identification across childhood;
- vii. Incorporated both simple and complex scenarios. Complexity was defined by (a) the complexity of the emotion involved, (b) the social context of the scenario, which may require more or less sophisticated social understandings

and have fewer or greater personal cues to assist the child in interpreting the situation (Hughes, Tingle, & Swain, 1981) (c) the number of characters in the scenario, and (d) the number of perspectives that the child is asked to take in responding to a given item;

- viii. Counterbalanced the number of male and female figures in the scenarios in recognition of reported gender differences in some measures of empathic development as well as children's tendency to empathise with those more like themselves (Braza et al, 2009; Catherine & Schonert-Reikle, 2011; Eisenberg, Fabes, Schaller, & Miller, 1989; Gini et al, 2007; Goldstein & Michaels, 1985; Hoffman, 1977);
- ix. In some scenarios, children were asked to sequentially take more than one perspective when answering these questions to assess empathy with protagonist, victim and/or bystander.

The original emotion stimuli and scenarios were piloted first with a convenience sample of adults to ensure consensus about the correct answers and secondly, with primary school aged children to ensure that children could consistently and correctly identify the emotion response stimuli and that there was consistency in the interpretation of each of the scenarios.

In sum, children are presented with 12 'faceless' pictographic stimuli and one additional sample item and asked to infer and ascribe to a person or persons in each image one of six pre-identified emotions, by pointing to a picture of the relevant facial expression or by verbally labelling the associated emotion. Stimuli consist of simple line

drawings of events with either single or multiple characters' faces left blank (see Figure 1). Once presented with individual stimuli, children are prompted with a series of test questions (see Table 1); an affect inference question ("how do you think this boy/girl/man feels"), a cognitive question and prompt ("can you tell me why this boy/girl/man feels (previous response)?"; then "please tell me more about what is happening") and an other-referenced behavioural question ("What would you do, if you were that boy/girl/man?"). In six scenarios, two characters have blank faces and children are subsequently asked the same series of questions in relation to the second child/person.

[Table 1 & Figure 1 about here]

Prior to administration of the visual stimuli and test questions, children are shown the set of drawings of response faces and asked to identify the six mental and emotion states that are used in the task. Responses to all test questions are scored in such a way that complexity, appropriateness (contextual relevance and consistency of responses), prosocial behaviour/positive adaptive intervention and justification are rewarded with higher scores to reflect greater empathic ability.

### **Other measures**

In order to assess the performance of this new measure, participants were administered a number of existing empathy measures, as well as measures of verbal ability, general cognitive ability and executive functioning. Additional empathy measures allowed investigation of construct validity by exploring the alignment of cognitive, affective and behavioural components of the KEDS with measures



differentially reflecting these empathic features. Cognitive measures allowed investigation of previous findings that empathic ability is dependent upon general cognitive ability and also afforded the potential for construct differentiation between the cognitive subscale and the affective and behavioural subscales. Executive functioning was assessed in recognition of the role of self-regulation and selective attention in the regulation of both cognition and emotion (Singer & Lamm, 2009). These measures are described below.

### **Empathy measures**

**Emotion Vocabulary Test (Dyck, Ferguson, & Shochet, 2001).** The Emotion Vocabulary Test (EVT) is an individually administered 12-item measure of the ability to define emotion words (e.g., What does the word happy mean?).

**Emotion Recognition Task.** A computerised version of a facial emotion recognition task (Baron-Cohen, Wheelwright, & Joliffe, 1997) in which stimuli consist of black and white photographs depicting a woman's face (head), displaying basic emotions and mental states.

**Happé Strange Stories test (Happé, 1994).** The Strange Stories test is an advanced theory of mind task that assesses the ability to provide context-appropriate mental state explanations to characters in 12 short vignettes. Due to time restrictions only six items were selected for administration in this study.

**Bryant Empathy Questionnaire (Bryant, 1982).** The BEQ is a child-appropriate extension of the Mehrabian and Epstein adult measure of emotional empathy (Mehrabian & Epstein, 1972). Administration involves reading out the 22 items of the questionnaire

to the child, while they respond by circling their agreement or disagreement with a particular statement (e.g. “Do you think people who kiss and hug in public are silly?”).

### **Cognitive measures**

**Cattell Culture Fair Intelligence Test – Scale 2, Form A (CCFIT; Cattell & Cattell, 1960).** The CCFIT is thought to be one of the purest non-verbal measures of fluid intelligence (Duncan, Burgess, & Emslie, 1995).

**Wechsler Intelligence Scale for Children – IV (WISC; Wechsler, 2003).** Ten subtests (eight core subtests, two supplementary) of the WISC-IV were administered in order to calculate its four composite indices of Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), Processing Speed (PSI), and Full-Scale IQ.

**Wisconsin Card Sorting Test (WCST; Heaton, Chelune, Talley, Kay, & Curtiss, 1993).** The WCST is considered a measure of executive functions as it involves the implementation of attention, cognitive set-shifting, inhibition and response modulation in a card sorting game as a result of environmental feedback.

### **Procedure**

All participants were recruited and assessed in compliance with the University of Western Australia Human Research Ethics Committee’s guidelines and procedures.

A maximum number of 24 children attended each day for two consecutive weekdays. All measures were individually administered and all standardised test administration procedures were maintained. All measures were implemented in the same order for each child. Measures utilised for this study are a subset of measures undertaken

as part of a large ARC grant to provide a comprehensive neurocognitive profile for each child. This subset of measures took 3-4 hours to complete. The KEDS took 15-20 minutes to administer. Trained researchers, who had prior experience working with young children administered all assessments.

Scoring was undertaken by the examiner on completion of the task, and also independently by two other assessors. Scoring criteria can be found in Table 1. In the few instances where discrepancies occurred, these were resolved through consultation between the three assessors.

## Results

### **Affect, Cognition, and Behaviour Scales: Internal Consistency and Scaling**

KEDS items assessing affective, cognitive and behavioural empathy were separately submitted to Rasch modelling. The overall fit test of the Affect and Cognition items revealed a significant deviation from unidimensionality,  $\chi^2(16) = 35.50, p = .003$ , and  $(\chi^2(28) = 88.00, p < .001$ , respectively. However, the Behaviour scale showed good fit overall,  $\chi^2(16) = 22.45, p = .13$ . Cronbach's alpha was .63 for Affect, .82 for Cognition, and .84 for Behaviour.

Rasch difficulty estimates and fit indices (Andrich, Sheridan, & Lyne, 1991) for individual items are shown in Table 2. The items on the Affect scale show a wide range of difficulty (-2.02 to 1.66). Difficulty of inferring simple emotions was no lower than inferring complex emotions,  $t(15) = 1.08, p > .05$ . However, excluding the Ring-a-Rosie outcast item (which was extremely easy), identifying emotions in scenarios involving more than one character was significantly more difficult than in scenarios with one

character,  $t(14) = 3.12, p = .007$ . Three items deviated significantly from the unidimensional model. The Cognition and Behaviour scales showed more restricted ranges of difficulty, and these were not associated with the complexity of the emotion or the number of characters. Eleven questions of the 29 on the Cognition scale deviated significantly from unidimensionality. All but one of these over-discriminated, which is of less concern than under-discrimination (Wilson, 2010). All cognitive questions from the scenario about the child being scolded by an adult, and about one child kicking another, deviated significantly. Three of the other deviating Cognition questions were invitations to elaborate on reasons for characters' affect in relatively simple, single-character situations, which may have required children to construct narrative details beyond the scenario depicted, and may represent a different ability. It also constitutes a poorly constructed item that will be modified in subsequent versions of the scale.

Although three items deviate significantly from unidimensionality in the Behaviour scale, this is of minor concern given the good overall fit (Andrich, et al., 1991). The difficulty of Affect inference for each item did not correlate with the difficulty of the corresponding Cognitive question,  $r(15) = -.06, p > .05$ , nor did the difficulty of Affect and Behaviour questions,  $r(15) = .20$ , or Cognition and Behaviour questions,  $r(15) = -.23$ .

### **Item Totals: Internal Consistency and Scaling**

Items were scored as the total of Affect, Cognition and Behaviour, with scores from all questions summed within each character. Cronbach's alpha for the 17 characters was .84. The data did not deviate significantly from the unidimensional model overall,

$\chi^2(16) = 25.18, p = .07$ , although one item, the sandcastle vandal, deviated significantly (Table 2).

[Table 2. about here]

Although the results of the Rasch analysis indicate that total scores for KEDS can reasonably be treated as unidimensional, we wished to test for the possible existence of subscales. Principal components analysis with varimax rotation produced four orthogonal factors (Table 3), explaining 52.44% of the variance. The first factor has its highest loadings from items involving primarily single characters and positive emotions, and moderate loadings from items involving victims in unhappy situations where affect could be inferred without reference to other characters' mental states. We labelled this factor *Simple*. The second factor involved items where characters in the scenario were children experiencing conflicting emotions (Sandcastle and Ring-a-Rosie) or where an expectation is violated (gift unwrapping scenario). All of these involve reconciling two perspectives. We labelled this factor *Complex*. The third factor comprised items where children were in conflict and either attacking or taking advantage of the other character. We labelled this factor *Aggression*. The fourth factor had its major loadings from a scenario involving a parent/child interaction. We labelled this factor *Authority*. Individual factor scores were calculated for these three components.

[Table 3. about here]

### **Construct validity**

To test whether affective, cognitive and behavioural empathy were distinct from each other, scores from each of the scales were correlated with each other. Affect scores correlated .02 with Cognition scores ( $p > .05$ ), and -.07 with Behaviour scores ( $p > .05$ ).

Cognition scores correlated with Behaviour scores at .41 ( $p < .001$ ). Thus, Affect showed little overlap with the other dimensions, while Cognition and Behaviour showed moderate overlap. Controlling for age, these correlations were -.01 (*n.s.*), -.07 ( $p > .05$ ), and .42 ( $p < .001$ ), respectively. Total scores on the test correlated .27 with Affect scores, .80 with Cognition scores and .80 with Behaviour scores (all  $p < .001$ ), indicating that total test scores are primarily indicators of cognitive empathy and prosocial behaviour.

### **Convergent and Discriminant Validity**

**Age and Gender.** Table 4 shows the mean scores for male and female children in each age group on the KEDS measures. Two-way between groups ANOVA for each measure showed significant age effects for Total,  $F(1,205) = 6.24, p = .013$ , Affect,  $F(1,205) = 19.51, p < .001$ , Cognition,  $F(1,205) = 4.03, p = .046$ , but not Behaviour,  $F < 1$ . Gender effects in favour of females were significant for Total,  $F(1,205) = 7.97, p = .005$  and Cognition,  $F(1,206) = 6.81, p = .010$ . No Age x Gender interaction was significant.

[Table 4. goes about here]

**Other empathy measures.** Table 5 shows the range of scores on other empathy measures used in this study and Table 6 shows the correlations among the KEDS measures and other empathy measures: the BEQ, Strange Stories, EVT and the Emotion Recognition task. KEDS total score and Cognition score correlated significantly with all of the measures except the emotion recognition task. In contrast, Affect scores are only significantly associated with EVT and emotion recognition accuracy, and only prior to

controlling age. Behaviour scores correlate positively with the BEQ and EVT. The Simple subscale correlates positively with EVT. The Complex subscale correlates with EVT and Strange Stories. The Aggression factor scores only correlate with the BEQ. The Authority factor scores do not correlate significantly with any of the existing empathy measures. Thus, while the KEDS overlaps in its measurement with existing measures, with the exception of its Authority factor, its subscales are differentially related to other measures.

[Table 5 and then Table 6 about here]

**Cognitive ability measures.** Table 7 shows the correlations between the KEDS measures and measures of cognitive ability: the WISC-IV VCI, PRI, WMI, PSI, and FSIQ; the CCFIT, and the Wisconsin Card Sorting Task and Perseverative Errors (WCST-PE).

The WISC-IV VCI, PRI, FSIQ and Cattell Culture Fair IQ all show significant positive correlations with KEDS Total score, Affect, Behaviour and Simple scores. VCI is also correlated with Cognitive score. WISC-IV WMI correlates positively with KEDS Total and Affect scores only, and WISC-IV PSI is uncorrelated with any of the KEDS measures. Perseverative errors on the WCST (raw and standard scores) are associated with lower KEDS total, lower Affect and Behaviour (but not Cognition) scores, and lower scores on the Simple and Aggression factor. For comparison, Table 8 shows correlations between other empathy measures and cognitive measures. It can be seen that the KEDS scales show weaker correlations with WISC indices than all existing measures of empathy except the BEQ, which is a self-report measure.

[Table 7 about here]

[Table 8 about here]

## **Discussion**

The results of this study generally support the proposition that affective, cognitive and behavioural empathy are distinguishable and indicate that the KEDS is successful in differentiating these facets. Furthermore, our results reveal some new issues of importance in understanding empathy.

### *Total score*

Total score on the KEDS showed significant overlap with the constructs that other measures of empathy assess, but was distinguishable from these. It showed good internal consistency and little deviation from unidimensionality. It showed the predicted association with age and gender, and was somewhat associated with intelligence measures and inhibitory control on the WCST.

### **Affect, Cognition and Behaviour Scales**

There was also evidence of distinguishable facets of empathy within the measure. We found evidence that the affective, cognitive, and behavioural subscales were relatively independent of each other. Children's scores on the Affect scale showed near zero correlations with the other two, which, in turn showed a modest association. Further evidence for the distinctness of the three scales comes from the relatively low correlations between difficulty estimates of questions from the three scales for corresponding scenarios: the difficulty in inferring affect for a particular scenario, for example, is not closely related to the difficulty of explaining how the affect arose, or the difficulty of devising an appropriate course of action. Situational demands or rules may mediate these



aspects of empathy. The wide range of difficulty of Affect items resulted in the most modest internal consistency of the three scales and may reflect the fact that some scenarios have such strong universality of affect (e.g. child is afraid of the dark; child is sad when left out of a game) that there may be a bypassing of active affective inference. Conversely some items may have been so socially loaded with rules and expectations that ambivalence may have impacted the affective inference process (e.g. a child is being scolded by an adult). There is emerging evidence that the processing of deontic rules in social situations may take primacy and can occur independently from perspective taking (Clement et al., 2011). Imposed, overlearned and universal responses to interpersonal situations may have less to do with empathy and more to do with operant condition and evolutionary advantage, but both may be related to prosocial or socially adaptive behaviour in young children, as they are in adolescence (López, Pérez, Ochoa, & Ruiz, 2008).

The correlations between our scales and existing measures of empathy offer further evidence that they measure distinct variables. The BEQ (Bryant, 1982), which measures self-reported empathic feelings, was not related to children's Affect scores. It was, however associated with higher Cognition and, particularly, Behaviour scores. As suggested earlier, the BEQ may be more sensitive to social desirability effects than to the ability to accurately infer the affective states of others. Alternately, the lack of correlation between Affect and BEQ may be further evidence that people's self-reported abilities are often poor predictors of their objective abilities (Christiansen, Janovics, & Siers, 2010). Nevertheless, the BEQ also correlated with the KEDS Cognition scale, suggesting that children's ability to give plausible explanations for others' feelings may

be related to their view of themselves as an empathic individual, even if the feelings they are explaining are inaccurately judged. A further consideration is that the associations between the BEQ and KEDS scales show little sign of mediation by age, indicating that what they have in common is not simply variation in maturity.

The Happé Strange Stories test (Happé, 1994), the measure of advanced theory of mind, was exclusively related to the KEDS Cognition scale, indicating that both measures tap into an ability to give verbal explanations of human behaviour in terms of mental states.

Emotional vocabulary (Dyck, et al., 2001) correlated positively with all three KEDS scales. As a verbal test with emotional content, its correlation with the Cognition scale is unsurprising. At first glance, the correlation with Affect may appear to be due to accurate emotion identification being limited by vocabulary, however, given that Affect responses were given non-verbally and that all children were able to correctly match faces on the response card to emotional state words, this interpretation is less plausible. It may be that both measures reward responses that demonstrate a nuanced understanding of emotional states. While the correlation of EVT with Affect was age-mediated, its correlation with Cognition was largely independent of age. A possible reason for this may be that a number of words in the EVT relate to inherently social emotions (e.g., guilt, betrayed) and that good understanding of these emotions, as distinct from primary individual-focused emotions, may contribute to explicit understanding of the reasons underlying affective responses.

The Emotion Recognition task was specifically associated with the Affect scale. Higher Affect scores were associated with accuracy on this task prior to controlling for

age. Thus, the ability to infer emotional responses from situational cues was weakly associated with more accurate context-free emotion recognition. Although in real life, good emotional inferential ability may well facilitate emotion recognition by priming appropriate emotions, the direction of causality is unlikely to run in this direction in the present study where the Emotion Recognition task provided no context to allow such priming. Instead, it seems most likely that both tasks call for an ability to distinguish among emotions, including making nuanced distinctions between those of the same valence, and that this improves with age.

In sum, the modest relationships between the KEDS and existing measures was unsurprising given that there is no other single measure that concurrently differentiates these three different aspects of empathy. Some measures overlap or unsystematically combine aspects of empathy that are differentiated within the KEDS scale while others target only a narrow part of one aspect of empathy (e.g. emotion vocabulary). However the pattern of relationships between the subscales and related measures supports the view that this conceptualisation of empathy and the distinctions between the different elements of empathy warrants further exploration.

Turning to the associations between the KEDS scales and measures of cognitive abilities, is it noteworthy that KEDS generally showed less overlap with cognitive ability than did the other empathy measures suggesting less of a confound with general cognitive abilities. However, all three KEDS scales showed significant correlations with the WISC-IV VCI, suggesting that general verbal comprehension and acquired social knowledge plays a role in performing well on the KEDS. This is not surprising given the

current conceptualisation and operationalization of affective empathy as active affective perspective taking or inference, a higher order cognitive process rather than a lower order process such as emotional contagion which would be less likely to be related to VCI. Similarly for behavioural empathy as currently defined. Rather than agreeing with statements about the kinds of behaviour an individual generally undertakes, this scale rather requires actively putting oneself in the shoes of another across a range of unexpected scenarios, and inferring what that person might do.

Interestingly, the correlation between the Cognitive scale and WISC-IV VCI was less strong than other KEDS scales and other empathy measures, most likely because the cognitive and verbal load was reduced in the Cognitive scale (compared to the other scales of the KEDS) by scaffolding the question in two parts. Each part oriented the child to the kind of response required (i) why the target child might feel as they do; and (ii) describing the nature of the situation. Moreover, the Cognitive scale, unlike the Affective and Behavioural scales of the KEDS, does not in most cases, require the child to go beyond the stimulus picture to derive (or infer) an answer – the required material is able to be found within the picture scenario.

The PRI was associated with Affect and Behaviour, but not Cognitive scores. This might be explained to the extent that the PRI indicates perceptual acuity and behavioural planning in novel situations if Affect and Behaviour require children to “think on their feet,” while the Cognitive scale draws more on acquired knowledge and social experience. The similar pattern of results for WMI, fluid intelligence, full-scale IQ, and perseverative errors tend to support this interpretation. It is noteworthy that the difficulty of items on the Affect scale was significantly related to number of characters in

the scenario. This may reflect the demands that mentally representing multiple points of view places on working memory capacity (Davis & Pratt, 1995; Oberauer, 2005).

It is pleasing that there is a modest relationship between general cognitive abilities and the KEDS' scales. Minimising this confound makes it more possible to use the KEDS to explore the nature of empathic abilities as a potentially independent process.

### *Situation specificity*

This study indicated that children's level of empathy was at least somewhat specific to different kinds of emotions and situations. This was evident from the relatively weak internal consistency of the Affect scale, from the four orthogonal factors that emerged from principal components analysis of the item total scores, and from these factors' disparate associations with other measures. The factors were interpreted as representing simple emotions, complex emotions and social situations, empathy for the aggressor in conflicts between peers, and parent-child conflict. From the 12 KEDS items, it is not easy to disentangle fully the emotions captured in each factor from the social setting in which they occur – for example, it is not clear whether the first factor items cohere because of the happy/unhappy nature of their emotions, or because they do not require multiple perspectives to be taken. The latter two factors correspond to Equality matching and Authority ranking : two of Fiske's (1992) four social models, proposed to provide implicit structure for all human relationships, and, among other functions, define salient emotions: for example, vengefulness and respect. The nexus between social models and empathy may be a possible avenue for future research.

Scores on the Simple factor were associated with higher IQ, fluid intelligence, verbal comprehension, perceptual reasoning, and fewer perseverative errors. They were

also associated with higher emotional vocabulary scores. This aspect of empathy thus appears to have commonalities with general cognitive ability and with the most IQ-correlated empathy measure. The Complex factor, in contrast, showed no association with the cognitive measures, but was significantly correlated with all of the other empathy measures, except speed of emotion recognition. This suggests that understanding of complex social scenarios may rely more on domain-specific empathic ability and less on general cognitive ability than understanding of simple social scenarios. Higher scores on the Aggression factor were associated with higher self-reported empathy, suggesting that aggressive situations might provide children with salient cues to their empathic competencies (or limitations). Good performance on the Aggression factor was also associated with good inhibitory control on the WCST. Recent research suggests a negative relationship between overt aggression and inhibitory control, which, taken with our results may indicate that less impulsive children engage in more empathic processes and less direct action in hostile situations (Runions & Keating, 2010). However, Runions and Keating's study also indicates a complex relationship among the variables of inhibitory control, attributions of hostile intent, anger, and aggression. Given that understanding and preventing aggression is an underlying motivation for much research into empathy, it is noteworthy that this factor emerged as distinct from other aspects of empathy.

In contrast, the Authority factor showed little overlap with the other measures. Items from this scenario deviated from the rest of the scale under Rasch analysis, produced an orthogonal factor under principal components analysis, and did not correlate with any existing empathy measures. While it is unwarranted to make generalisations

based on a factor derived largely from a single KEDS scenario (albeit a scenario requiring multiple perspectives to be considered), we observe that this was the only scenario that required children to empathise with both members of an adult-child dyad. As discussed earlier in relation to the Affect scale, it is likely that adult-child roles and relationships are more constrained by adults and deontic rules from an early age, whereas peer roles and relationships may draw more upon in vivo decision making and negotiation with an 'equal' (Kruger, 1992). This distinction resonates with Vygotskian versus Piagetian claims about the role of social interaction in cognitive development, emphasising unequal and equal status partnerships, respectively, and resulting in acquisition of knowledge of cultural rules versus perspective taking (see Rogoff, 1999, for discussion). There is emerging evidence that the processing of deontic rules in social situations may take primacy and can indeed occur independently from perspective taking (Clement et al., 2011), although both may be related to prosocial or adaptive behaviour in young children, as they are in adolescence (López, Pérez, Ochoa, & Ruiz, 2008). Further research would be required to determine whether it was simply a poor item, or whether it was the sole representative on the KEDS of an important facet of children's empathy.

### *Conclusion*

In this paper, we describe a new multi-faceted, theoretically integrated, measure of empathy for school-aged children. We found psychometric reasons for distinguishing between empathic Affect, Cognition and Behaviour referent to the same stimulus material. While the Behaviour scale showed good internal consistency, children's Cognitive empathy and ability to infer Affect was not general, but specific to the kind of emotion and social scenario depicted. We found reason to distinguish between empathy

in simple scenarios where only one point of view needs to be considered, which was related to general cognitive ability; empathy in complex, multi-perspective scenarios, which was related to a range of existing empathy measures; empathy in situations involving aggression; and tentative evidence of empathy specific to adult-child relations. Each of our measures of empathy displays a distinct pattern of associations with other measures of empathy and cognitive ability, as well as gender. We believe that the KEDS will offer researchers the ability to more carefully consider the most relevant dimension of empathy for their particular needs. In turn, the findings arising from our psychometric investigation of the measure also further our understanding of the empathy construct.

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Figure 1. Sample KEDS complex multi-perspective item: 'Ring-a-rosie'

Table 1.

## Example Scoring Criteria for Ring-a-Rosie scenario

Question	Example Response	Scoring Criteria	Score (0-2)
		Incorrect response, 'don't know' or no response	0
<b>Affective (1)</b>		Simple appropriate response to simple item.	1
<i>How do you think this girl feels?</i>	Sad	Partially correct or simple response for complex item.	1
		Complex appropriate response for complex item.	<u>2</u>
<b>Cognitive (1)</b>		Simple or partial response.	1
<i>Can you tell me why this girl feels sad?</i>	She is left out of the game	Full justification for scenario.	<u>2</u>
<i>Please tell me more about what is happening in this picture.</i>	The kids are playing together and this girl can't join in so she is sad.	Some (minimal) additional information is offered	1
		Additional information and reasoning given about story behind the picture.	<u>2</u>
<b>Behavioural (1)</b>		Where an action related to a different or non-dominant emotion is given.	1
<i>What would you do if you were that girl?</i>	Ask if I can join in.	Pro-social or other positive/adaptive behaviour is stated that clearly relates to the emotion.	<u>2</u>
<b>Affective (2)</b>		Simple appropriate response to simple item.	1
<i>How do you think this boy feels?</i>	Happy	Partially correct or simple response for complex item.	1
		Complex appropriate response for complex item.	<u>2</u>
<b>Cognitive (2)</b>		Simple or partial response.	1
<i>Can you tell me why this boy feels happy?</i>	He is included in the game but then he will be sad when he sees the girl.	Full justification for scenario.	<u>2</u>
<b>Behavioural (2)</b>		Where an action related to a different or non dominant emotion is given	1
<i>What would you do if you were that boy?</i>	I would invite her to join in		



Pro-social or other positive/adaptive behaviour is stated that clearly relates to the emotion.

2

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†Note: In the same way as it is possible for a child to correctly identify an emotional response but not to be able to provide a cognitive description or a positive behavioural response, so it is also possible for a child to gain a score for generating a prosocial or positive behavioural response despite not being able to correctly identify the emotion being experienced by the target child. This scoring system reflects the belief that it is conceptually possible (though not typical) for each element of empathy to operate independently.

Table 2

*Rasch Difficulty Estimates and Item Fit for Affect, Cognition, Behaviour Scales and Total Scale*

Item	Label	Affect		Cognition		Behaviour		Total	
		Difficulty (SE)	Fit $\chi^2$	Difficulty (SE)†	Fit $\chi^2$	Difficulty (SE)	Fit $\chi^2$	Difficulty (SE)	Fit $\chi^2$
2	Swings – happy	-.21 (.16)	4.79***	-.34 (.18)	1.02	.34 (.11)	.01	.01 (.07)	.33
3	Broken arm – sad	.24 (.15)	.55	1.11 (.13)	2.48	.57 (.10)	.77	.55 (.06)	1.78
4	Dark room – afraid	-1.88 (.27)	.53	-1.03 (.19)	1.94	-.53 (.14)	3.99*	-.20 (.07)	1.12
5a	Toy fight boy - angry	.18 (.15)	1.12	.38 (.13)	1.05	-.18 (.11)	1.25	.37 (.07)	.01
5b	Toy fight girl - angry	1.02 (.15)	11.38***	1.69 (.18)	3.52*	-.15 (.11)	.00	-.66 (.07)	1.51
6	Watching TV - relaxed	.48 (.15)	.07	-.71 (.11)	1.49	-.10 (.11)	1.53	.96 (.07)	2.09
7	Jack-in-the-box – surprised	-.53 (.17)	1.32	-1.32 (.20)	.52	.49 (.11)	.18	.10 (.06)	1.58
8a	Ring-a-rosie outcast - sad	-2.02 (.21)	.49	.89 (.11)	3.31*	-.43 (.14)	.82	.24 (.07)	.40
8b	Ring-a-rosie in - happy	-.03 (.17)	1.58	-.23 (.16)	7.32***	-.74 (.12)	.05	-.81 (.08)	.75
9a	Kick fight victim - afraid	.60 (.16)	.37	-.85 (.19)	15.26***	.04 (.12)	.52	.04 (.07)	2.86
				.81 (.11)	7.64***				

9b	Kick fight aggressor - angry	1.66 (.12)	2.21	-.29 (.13)	5.75***	.03 (.11)	.05	-.42 (.06)	1.46
10	Rocking chair - relaxed	-1.28 (.15)	1.56	-1.22 (.21) 1.71 (.13)	.19 1.26	.77 (.11)	4.66**	.72 (.06)	.23
11a	Parent/child father – angry	.19 (.10)	3.77*	.12 (.14) 1.48 (.12)	3.14* 1.22*	.58 (.11)	.33	.44 (.05)	.63
11b	Parent/child child – afraid	1.61 (.13)	1.98	-.23 (.13)	5.78***	.51 (.11)	2.67	-.04 (.06)	2.71
12	Gift unwrapped – surprised	-.68 (.13)	2.90	-.90 (.20) .90 (.11)	.12 1.28	-.46 (.11)	.19	-.65 (.06)	1.10
13a	Sandcastle victim – sad	.98 (.14)	.05	-1.06 (.19) .93 (.11)	1.30 .65	-.35 (.12)	.13	.43 (.06)	1.33
13b	Sandcastle vandal - happy	-.33 (.11)	.84	-.76 (.15)	1.43	-.39 (.10)	5.29***	-1.06 (.06)	5.29***

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

† First row for each item in Cognition column refers to “why?” question, and second row to “tell me more.”

Table 3

*Item Loadings on Principal Components*

Item	Label	1	2	3	4
5	Watching TV – relaxed	.70	.13	-.02	.11
1	Playing on the Swings – happy	.69	.00	.07	.06
6	Jack-in-the-box – surprised	.66	.16	.08	.11
9	Relaxing in a rocking chair – relaxed	.62	.35	-.07	.05
3	Dark room – afraid	.52	.12	.38	.10
2	Broken arm – sad	.52	.09	.31	.26
4a	Fight over toy (girl) – angry	.51	.23	.18	.02
8a	Child kicks child (victim) – afraid	.45	.27	.25	.18
12a	Sandcastle kicked (victim) – sad	.10	.73	.11	.09
11	Unwrapping a gift – surprised	.40	.64	.01	-.02
7a	Ring-a-Rosie (outcast ) – sad	.40	.60	-.02	.00
7b	Ring-a-Rosie (in) – happy	-.10	.53	.50	.26
12b	Sandcastle kicked (vandal) – happy	.12	.49	.29	.02
4b	Fight over toy (boy) – angry	.15	.03	.79	-.07
8b	Child kicks child (aggressor) – angry	.12	.17	.66	.25
10b	Telling off child (child ) – afraid	.10	-.01	.15	.86
10a	Telling off child (father ) – angry	.26	.13	.03	.82
% Variance		19.20	12.85	10.46	9.94

Table 4

*Mean (SD) Scores on KEDS Scales by age and gender*

		n†	Affect	Cognition	Behaviour	Total
		220	(Max 27)	(Max 58)	(Max 51)	(Max 136)
Age group	Gender					
7-year-olds (7.05 - 7.98)	Male	56	17.04 (2.92)	25.66 (5.53)	27.02 (6.48)	69.71 (10.99)
	Female	60	16.95 (3.61)	28.17 (6.69)	27.92 (7.11)	73.03 (12.82)
9-year-olds (9.00 – 9.80)	Male	51	18.20 (3.15)	27.67 (5.34)	26.69 (6.45)	72.55 (8.93)
	Female	42	19.67 (2.67)	29.50 (6.10)	28.50 (5.18)	77.67 (8.79)

† 11 children with ages outside these categories were excluded from this analysis. These children ranged in age from 6.98 – 6.99 years, 8.35-8.92 years and 10.00– 10.75 years.

Table 5

*Mean (SD) and Range of Scores on other empathy scales by age and gender*

Age group	Gender	BEQ	Strange	Emotion Vocabulary	Emotion	Emotion Recognition RT (ms)
			Stories		Recogniton (%)	
7-year-olds	Male	10.93	10.64	7.04 (3.40)	75.75 (11.15)	3882 (884)
		(3.22)	(1.96)	0-15	45-95	2164-7057
		5-18	1-12	(n=56)	(n=53)	(n=30)
		(n=55)	(n=56)			
(7.05 - 7.98)	Female	13.02	11.14	7.97 (3.01)	79.74 (11.90)	4197 (1273)
		(3.26)	(1.02)	2-14	50-100	1883-6671
		7-20	8-12	(n=60)	(n=58)	(n=30)
		(n=59)	(n=59)			
9-year-olds	Male	12.47	11.76	10.51 (4.47)	82.14 (11.73)	2966 (1171)

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	(3.37)	(0.52)	1-20	45-100	1605-6266
	3-21	10-12	(n=51)	(n=49)	(n=21)
	(n=51)	(n=50)			
(9.00 – 9.80) Female	14.24	11.45	10.93 (4.61)	86.00 (10.08)	2787 (649)
	(3.08)	(1.25)	2-20	55-100	1858-4442
	6-19	6-12	(n=42)	(n=40)	(n=17)
	(n=42)	(n=42)			

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Table 6

*Correlations between KEDS Empathy Scales and Other Measures of Empathy*

	KEDS Total	Affect	Cognition	Behaviour	Simple	Complex	Aggression	Authority
BEQ (n = 218)	.21** (.19**)¹	.02 (-.02)	.14* (.13)	.20** (.21**)	.08 (.06)	.15* (.14)	.16* (.17*)	.05 (.04)
Strange stories (n = 218)	.19** (.16*)	.10 (.02)	.19** (.16*)	.10 (.11)	.10 (.07)	.17* (.17*)	.04 (.06)	.06 (.04)
Emotional Vocabulary (n = 220)	.27*** (.25***)	.16* (.08)	.18** (.15*)	.21** (.24***)	.26*** (.23**)	.20** (.20**)	-.06 (-.05)	.06 (.03)
Emotion recognition accuracy (n = 210)	.11 (.08)	.16* (.10)	.07 (.05)	.04 (.04)	.08 (.05)	.13 (.12)	.04 (.06)	-.06 (-.08)
Emotion recognition RT (n = 104)	-.15 (-.11)	-.12 (.00)	-.10 (-.06)	-.12 (-.15)	-.19 (-.15)	-.16 (-.16)	-.01 (-.04)	.11 (.18)

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

¹ Values in parentheses indicate partial correlations controlling for age.



Table 7

*Correlations between KEDS Empathy Scales and Measures of Cognitive Ability*

	KEDS total	Affect	Cognition	Behaviour	Simple	Complex	Aggression	Authority
WISC-VCI (n = 219)	.23**	.20**	.13	.17*	.20**	.08	.05	.10
WISC-PRI (n = 218)	.14*	.15*	.02	.14*	.19**	.00	.08	-.04
WISC-WMI (n = 218)	.15*	.14*	.06	.13	.08	.07	.04	.13
WISC-IQ (n = 215)	.19**	.16*	.08	.16*	.16*	.06	.07	.06
Cattell (n = 218)	.15* (.12)	.15* (.08)	.01 (-.02)	.16* (.18**)	.19** (.16*)	-.04 (-.06)	.12 (.15*)	-.04 (-.07)
WCST-PE (n = 216)	-.23** (-.21**)	-.24*** (-.20**)	-.09 (-.07)	-.18** (-.19**)	-.17* (-.15*)	-.10 (-.09)	.14* (-.15*)	-.02 (-.01)

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$ ; WISC-PSI correlations all small and n.s. and excluded from table;

<sup>1</sup> Values in parentheses indicate partial correlations controlling for age.

Table 8

*Correlations between Empathy Scales and Measures of Cognitive Ability*

	BEQ	SS	EV	ERacc	ERRT
WISC-VCI	.16*	.29***	.53***	.33***	-.28**
	(n = 217)	(n = 217)	(n = 219)	(n = 209)	(n = 104)
WISC-PRI	.05	.24***	.15*	.21**	-.26**
	(n = 216)	(n = 216)	(n = 218)	(n = 208)	(n = 104)
WISC-WMI	-.08	.14	.17*	.19**	-.23*
	(n = 216)	(n = 216)	(n = 218)	(n = 208)	(n = 104)
WISC-IQ	.03	.26***	.33***	.31***	-.33***
	(n = 213)	(n = 213)	(n = 215)	(n = 205)	(n = 103)
Cattell	.22**	.33***	.25***	.32***	-.38***
	(.17*)	(.25***)	(.13*)	(.25***)	(-.26**)
	(n = 216)	(n = 216)	(n = 218)	(n = 208)	(n = 103)
WCST-PE	.00	-.19**	-.24**	-.21**	.26**
	(.04)	(-.13)	(-.16*)	(-.15*)	(.17)
	(n = 214)	(n = 214)	(n = 216)	(n = 207)	(n = 103)

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$ ; WISC-PSI correlations all small and n.s. and excluded from table;

<sup>1</sup> Values in parentheses indicate partial correlations controlling for age.