



**Cognitive and Affective Processes Associated with  
Moral Reasoning, and their Relationship with Behaviour  
in Typical Development**

Submitted by Kate Littler, to the University of Exeter as a thesis for  
the degree of Doctor of Clinical Psychology, 5<sup>th</sup> May 2015

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## Table of Contents

Lists of Tables and Figures .....	7
LITERATURE REVIEW .....	8
Abstract .....	9
Introduction.....	11
Rationale .....	11
Theories of Moral Development .....	12
The Role of Cognitive and Affective Processing in MR .....	14
Objectives .....	15
Methods .....	15
Eligibility Criteria.....	15
Information Sources and Search Strategy .....	17
Data Collection Process.....	17
Synthesis of Results.....	18
Risk of Bias in Included Studies.....	18
Results .....	18
Study Selection .....	18
Study Characteristics and Synthesis of Results.....	19
Summary of Findings .....	32
Relationships between EFs and MR. ....	32
Relationships between affective processes and MR. ....	32
Critical Appraisal .....	33

Design.....	34
Sample.....	35
Measures.....	35
Statistical analyses.....	39
Discussion.....	39
Review Implications.....	40
Clinical implications.....	40
Future research.....	41
Limitations of the Review.....	44
Conclusions.....	44
References.....	45
Appendices.....	62
Appendix A: Glossary of terms.....	62
Appendix B: Data Extraction Form.....	64
Appendix C: The EBL Checklist.....	67
Appendix D: Instructions for Authors.....	68
EMPIRICAL PAPER.....	75
Acknowledgments.....	76
Abstract.....	77
Introduction.....	79
MR Theories.....	80
Cognitive and Affective Processes Associated with MR.....	82
Social Information Processing Theory (SIT).....	83

Relationships between MR, EFs, Empathy and Behaviour .....	85
Factors Contributing to the Relationship between MR and Behaviour .....	86
The Significance of Adolescence .....	87
Research Rationale.....	88
Research aim.....	89
Exploratory analyses.....	89
Method .....	90
Design.....	90
Participants .....	90
Sample size.....	91
Recruitment.....	91
Measures .....	92
Demographics.....	92
Intellectual functioning.....	92
Empathy.....	92
Executive functioning.....	93
Moral reasoning.....	94
Behaviour.....	95
Ethical Considerations .....	96
Procedure .....	96
Plan for Data Analysis.....	97
Data cleaning.....	97
Consideration of covariates.....	97
Plan for main analyses.....	97

Plan for exploratory analyses.....	98
Results .....	98
Preliminary Analyses.....	98
Main Analyses.....	101
Hypothesis one. ....	102
Hypothesis two.....	102
Hypothesis three. ....	103
Exploratory Analyses .....	103
Relative contribution of cognitive and affective processing to MR.....	103
Associations between sub-domains of MR and self-reported behaviour.	104
Association with gender. ....	104
Discussion .....	105
Theoretical Implications .....	109
Clinical Implications.....	111
Strengths and Limitations of the Study.....	111
Future Research .....	114
Conclusion.....	115
References .....	117
Appendices.....	134
Appendix A: Glossary of terms.....	134
Appendix B: Recruitment Flow Charts .....	136
Appendix C: Recruitment documentation.....	137
Appendix D: Copies of Assessments .....	155

Appendix E: Ethical Approval.....	167
Appendix F: Counterbalance Order for Assessments .....	168
Appendix G: Extended Plan for Data Analysis .....	169
Appendix H: Extended Results .....	171
Appendix I: Pearson Statement .....	174
Appendix J: Instructions for Authors.....	175
Appendix K: Dissemination statement.....	186

## Lists of Tables and Figures

### Tables

#### Literature review

Table 1. The inclusion and exclusion criteria used in the selection of articles.. 16

Table 2. Summary of the study characteristics and results from studies included in the review..... 20

Table 3. Critical appraisal of included studies using the EBL checklist..... 34

#### Empirical paper

Table 1. Sample characteristics..... 99

Table 2. Descriptive statistics for main variables..... 100

Table 3. Bivariate zero-order Pearson correlations among study variables... 101

Table 4. Hierarchical regression analysis..... 104

Table 5. Results for the association of variables with gender.....105

### Figures

#### Literature review

Figure 1. Study selection process..... 19

#### Empirical paper

Figure 1. Depiction of stages involved in SST..... 82

Figure 2. The SIT model..... 84

Figure 3. The three mediation models tested in this research..... 170



**SCHOOL OF PSYCHOLOGY**

**DOCTORATE IN CLINICAL PSYCHOLOGY**

**LITERATURE REVIEW**

**Cognitive and Affective Processes Associated with Moral Reasoning: A Systematic Review of the Literature**

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## Abstract

*Background:* Moral reasoning (MR) is rationalisation in the moral domain, which matures with age and can guide moral judgements (MJs) and behaviour. MR theories agree that higher-order cognitive processing (e.g., executive functions [EFs]) and affective processing (e.g., empathy, theory of mind [ToM] and emotion processing/recognition) are involved in MR, however, they disagree as to the relative contribution of these processes. Understanding these underlying processes has important implications in furthering the understanding of the concept of MR, and the complex social behaviours that MR influences, which range from altruism to offending.

*Objectives:* This review summarises the evidence for the association of cognitive (i.e., EFs) and affective (i.e., empathy, ToM, emotion) processes in MR.

*Methods:* A structured review of literature published before April 2015 was conducted using Medline, PsychINFO, Scopus, Embase, Applied Social Science Index and Abstracts, and Web of Science.

*Results:* Of the 2141 papers identified, 21 relevant papers were included in the review, consisting of case studies and cross-sectional studies.

*Conclusions:* There is preliminary evidence for positive correlations between EFs and MR, and empathy and MR, in a range of non-clinical, clinical and delinquent populations from childhood through to adulthood. Results are, however, inconsistent, and the methodological quality of evidence is generally poor. Furthermore, the evidence considering the role of emotion is extremely

limited, and studies have not yet investigated whether ToM is associated with MR. Recommendations for future research are presented.

**Key words.** *Moral reasoning; empathy; executive functioning; cognitive processing; affective processing.*

## Introduction

### Rationale

Social domain theory (Smetana, 2006; Turiel, 1983) postulates three domains of social knowledge: moral domain (e.g., justice, fairness, human rights), conventional domain (e.g., social rules), and personal domain (e.g., personal preferences of friendships, hobbies, etc.). Distinguishing moral and non-moral domains is important, as neuropsychological studies have demonstrated that transgressions in the moral domain are processed differently to transgressions in the conventional domain (Lahat, Helwig, & Zelazo, 2013; Lahat & Zelazo, 2012). Furthermore, individuals consider moral transgressions as less permissible, and more deserving of punishment than transgressions in other domains (Smetana, Jambon, Conry-Murray, & Sturge-Apple, 2012).

Moral reasoning (MR) reflects the cognitive and emotional processing that occurs when an individual is making a moral judgment (MJ), that is, making a decision in the moral domain (Moll, Zahn, Oliveira-Souza, Krueger, & Grafman, 2005). The development of MR (“moral development”) begins in early childhood and continues into emerging adulthood (Gibbs, 2014). Moral development is fuelled by opportunities for perspective taking and the maturation of neuronal circuitry in the prefrontal cortex, where the structures associated with the cognitive and affective processes thought to underpin MR occur (Baird, 2008; Raine & Yang, 2006). Although a rationalisation process, MR is essential for appropriate interpersonal interactions (Moll et al., 2005), social functioning (Dooley, Beauchamp, & Anderson, 2010), and is one factor underpinning offending (Gibbs, Basinger, Grime, & Snarey, 2007; Stams et al., 2006) and re-offending (van Vugt et al., 2011) in youth and adults.

Developmentally immature MR has been found in clinical populations, such as individuals with traumatic brain injury (TBI; Beauchamp, Dooley, & Anderson, 2013) and intellectual disabilities (IDs; McDermott & Langdon, 2014), and may be one reason for the increased offending rates in these populations. Moral development, therefore, represents a potential target for intervention to promote MR. Such intervention programmes could aim to increase social functioning in youth and/or vulnerable clinical populations, but could also be used in offending populations to reduce recidivism (Nucci & Narvaez, 2008). Such programmes have demonstrated some success in male juvenile offenders (Leeman, Gibbs, & Fuller, 1993), adults with TBI (Manchester, Wall, Dawson, & Jackson, 2007), adults with IDs (Langdon, Murphy, Clare, Palmer, & Rees, 2013) and typically developing adolescents (DiBiase, 2010; van der Velden, Brugman, Boom, & Koops, 2010).

Although MR is increasingly understood as central to many human endeavours (Youssef et al., 2012), empirical evidence considering which cognitive and affective processes underlie MR has not been critically evaluated. This is the aim of this structured review.

### **Theories of Moral Development**

Ambiguities have arisen in relevant literature, as research groups define and measure MR differently, and frequently use the terms “MR” and “MJs” interchangeably (Killen & Smetana, 2008). Furthermore, although MR theories agree that MR/MJs affect behaviour, they disagree as to the role of MR in making MJs, and to the relative contribution of cognitive and affective processing in MR (see Appendix A for a glossary of terms used in this section).

Blair (2006) describes that theories of moral development agree that MR skills advance due to the development of cognition and perspective-taking. Such development results in changes to moral schemata, where morally relevant knowledge is stored, which advances MR. Some theories of moral development emphasise the importance of cognition in MR (Kohlberg, 1969; Piaget, 1932), whilst others highlight the importance of emotion (Hoffman, 2000). Gibbs (2014) suggests that both cognition *and* emotion underpin MR, and that MJs are the product of MR. Gibbs further suggests that MR develops in two stages (immature and mature). Immature MR is characterised by egocentric rule-based adherence to authority, whereas mature MR involves consideration of the perspectives of others and the well-being of society. Research investigating these theories uses production and recognition measures of MR. Production measures require individuals to provide justifications for their MJs, whereas recognition measures require individuals to select a presented justification that best matches their reasoning. Using both measures, individuals are assigned a developmental stage of MR, based upon the theory of moral development being tested.

Social intuitionist theories, in contrast, posit a different role for MR and MJs. Haidt (2001) suggests that MJs are made on intuitive emotional responses, and MR is used to justify intuitions post hoc. Such theories measure MJs by using forced-choice responses to moral dilemmas. These measures have been criticised as the justifications, motives and intentions for decision-making are required to qualify whether the decision is moral or based upon factors falling outside of the definition of morality (Killen & Smetana, 2008). Studies utilising MJ measures, therefore, are not necessarily measuring the

*moral* domain, but may instead be measuring reasoning more generally. Such studies were thus not considered in this review.

Similarly, other adjacent literature uses the term “MR” to reflect reasoning in the conventional/personal domains. For example, children have been demonstrated to engage in prosocial behaviours (e.g., sharing/consoling others) that are frequently attributed to being “moral” (Warneken & Tomasello, 2009). Blasi (2005) argues, however, that in middle-childhood children experience a conflict between whether to gratify one’s own needs or attend to the needs of others in a context where there are no legal or formal social guidelines (the so-called “happy-victimizer phenomenon”), and so prosocial behaviours are not necessarily “moral” acts. Research investigating the happy-victimizer phenomenon, therefore, is not necessarily investigating reasoning in the moral domain. Subsequently, such research was also not considered in this review.

### **The Role of Cognitive and Affective Processing in MR**

The positive association between intelligence and MR is well-established, and was summarised in a recent systematic review (Langdon, Clare, & Murphy, 2010). More specifically, theories of moral development hypothesise that higher-order cognitive functions, such as executive functions (EFs), are important in the development of mature MR (Colby & Kohlberg, 1987; Gibbs, 2014). For example, cognitive flexibility may allow individuals to consider alternatives; cognitive inhibition may prevent inappropriate responding; and working memory may help individuals process and manipulate morally salient information (Gibbs, 2014). Affective processes allow processing of emotionally relevant cues. Empathy assists individuals to correctly identify and respond to

the emotional states of others (Decety & Jackson, 2004; Preston & de Waal, 2002). Empathy requires brain networks associated with the processing of emotions (Völlm et al., 2006), therefore, emotion processing and recognition may also be associated with MR. Furthermore, effective social perspective taking requires the integration of empathy and theory of mind (ToM; Shamay-Tsoory, Harari, Aharon-Peretz, & Levkovitz, 2010; Watt, 2007), therefore, ToM may be associated with MR.

## **Objectives**

The aim of this structured review is to identify and critically evaluate empirical evidence considering which cognitive and affective processes are associated with MR (i.e., reasoning in the moral domain). Research investigating MJs and the happy-victimiser phenomenon was, therefore, excluded, as this research does not necessarily investigate the moral domain. Understanding the cognitive and affective processes underpinning MR would allow further insight into the construct of MR, and may improve understanding of the range of complex human behaviours that MR influences. Due to the hypothesised importance of EFs, empathy, ToM and emotion processing/recognition in MR theories, and the limited consideration of these variables in previous reviews, these were the focus of the current review.

## **Methods**

### **Eligibility Criteria**

To ensure a standardised approach to the review, the PRISMA reporting protocol was used (Moher, Liberati, Tetzlaff, & Altman, 2009).

Inclusion/exclusion criteria for selection of studies are outlined in Table 1.

Table 1

*The inclusion and exclusion criteria used in the selection of articles*

Inclusion criteria	Where criteria applied
<i>Empirical research of any study design</i>	<i>Research design</i>
<i>Human participants of any age</i>	<i>Sample</i>
<i>Any population, including clinical, non-clinical and delinquent samples</i>	<i>Sample</i>
<i>Any publication date</i>	<i>Duration of data collection</i>
<i>Published research in any peer reviewed journal</i>	<i>Publication type</i>
<i>English language only</i>	<i>Language</i>
<i>MR defined as reasoning about moral dilemmas in the moral domain (i.e., reasoning about dilemmas related to issues of justice, fairness, human rights, welfare and deliberate harm)</i>	<i>Content</i>
<i>Cognitive processes defined as executive functioning and cognitive empathy</i>	<i>Content</i>
<i>Affective processes defined as affective empathy, ToM and emotion processing/recognition</i>	<i>Content</i>
Exclusion criteria	Where criteria applied
<i>Studies which used an outcome variable other than MR (e.g., studies which used behaviour as an outcome)</i>	<i>Content</i>
<i>Studies that did not investigate the moral domain (e.g., studies that investigated the personal or conventional domain, or studies that investigated prosocial MR)</i>	<i>Content</i>
<i>Studies that investigated MJs rather than MR (i.e., studies that used measures where moral ability was judged on participants answering forced choice "yes" or "no" responses to moral dilemmas)</i>	<i>Content</i>
<i>Studies that did not investigate the specific cognitive and affective processes as defined by the inclusion criteria</i>	<i>Content</i>



## Information Sources and Search Strategy

The literature search was conducted in the databases PsychINFO, Medline, Scopus, Embase, Applied Social Science Index and Abstracts, and Web of Science using the search terms [(“moral reason\*” OR “moral develop\*” OR “moral judgment” OR “moral judgement<sup>1</sup>” OR “moral decision\*”) AND (“executive function\*” OR “executive process\*” OR “empathy” OR “theory of mind” OR “emotion\*”)] within the title and abstract. Studies published after the search date (15.03.2015) were not included. Limits were set on English language, peer reviewed journals and human participants.

To ensure all relevant papers were obtained, a manual search of articles in the reference lists of included studies was conducted, and backward and forward citations from included papers were screened.

## Data Collection Process

References from the searches were exported into Endnote Version X7.2.1. Duplicates were removed and titles and abstracts screened for relevance based upon eligibility criteria (Table 1). To reduce risk of bias and error, a second reviewer checked 50% of these studies to ensure adherence to eligibility criteria. Disagreements were discussed until consensus was reached. The full texts of papers deemed to meet the review’s criteria were obtained, and checked to ensure they met eligibility criteria.

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<sup>1</sup> Note on terminology: As explained in the Introduction and Methods, MJ studies were excluded from the review. However, as outlined in the Introduction, studies investigating MR/MJs frequently use the terms interchangeably. Therefore, to not exclude any relevant papers which examined MR as defined in this review, the terms “moral judgment/moral judgements” were included in the search strategy, in addition to the term “moral reasoning”.

## **Synthesis of Results**

Data were extracted from included papers using a data extraction form (Appendix B). Only aspects relevant to the research question were extracted, discussed and critiqued. An exception was the results for cognitive distortions. Although not directly relevant to the review question, studies reported that cognitive distortions influenced the relationship between MR and empathy. Not extracting these results, therefore, would have biased the review's conclusions.

## **Risk of Bias in Included Studies**

The EBL checklist was used to critically evaluate the papers (Glynn, 2006; Appendix C). The EBL checklist can be used to generate scores concerning the quality of the study's design, sample, data collection strategy and results, and additionally yields an overall quality score. Based upon the method of Amini, Alavian, Kabir, Hosseini, and Aalaei-Andabili (2011), the overall score was used to assign a quality rating for each study: low (overall score < 40%), moderate (40-70%), or high (> 70%). A second rater scored 10% ( $n = 2$ ) of included papers. Inter-rater reliability was calculated with the two-way mixed effects intraclass correlation coefficient as  $r = .96$  ( $p < .001$ ), indicating excellent reliability. A qualitative evaluation of the studies is also presented.

## **Results**

### **Study Selection**

The study selection process (Figure 1) resulted in inclusion of 21 articles in the review.

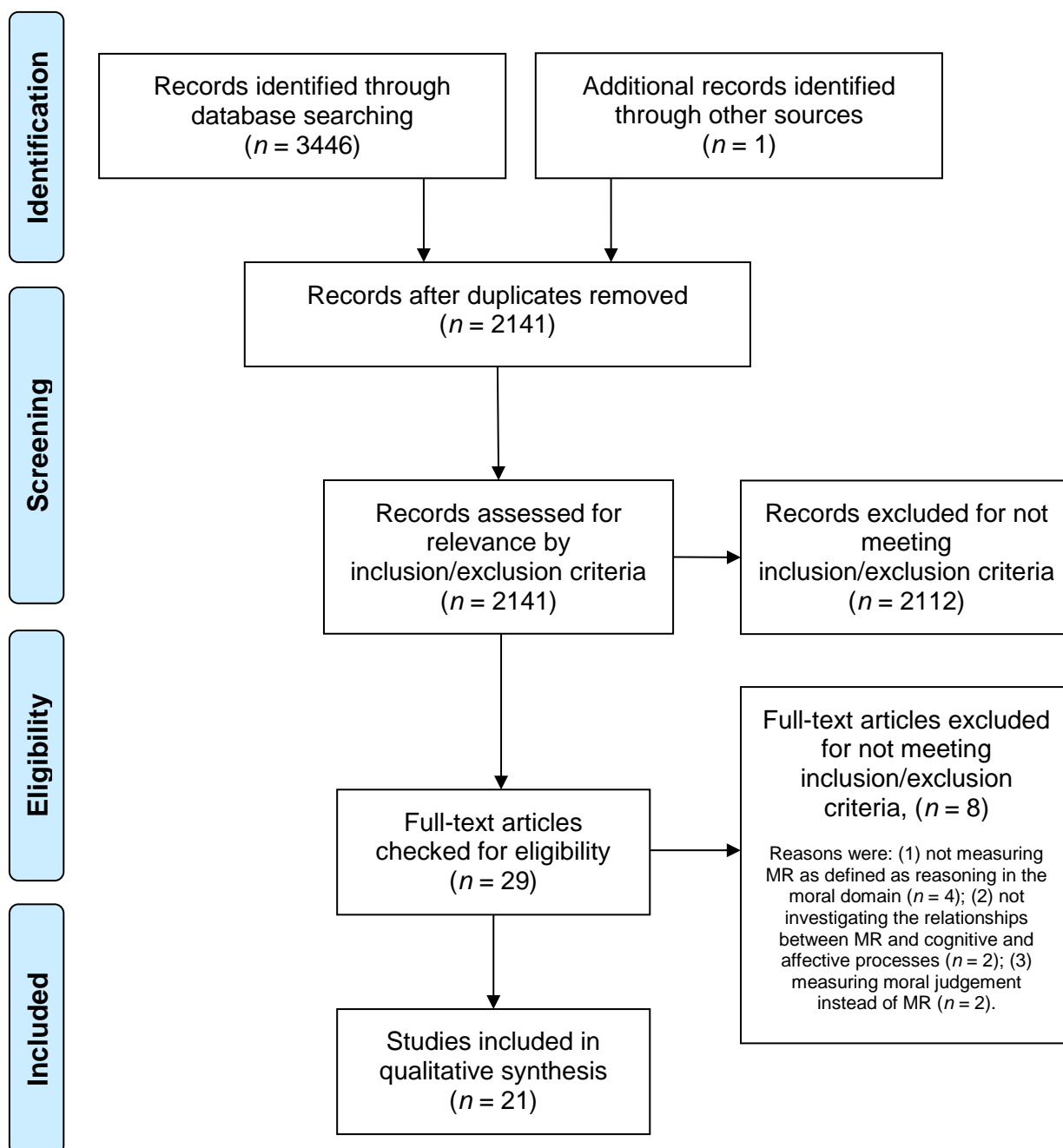


Figure 1. Study selection process.

## Study Characteristics and Synthesis of Results

The characteristics of included studies and results are summarised in Table 2.

Table 2

Summary of the study characteristics and results from studies included in the review<sup>2</sup>

Study Type	Authors	Study # <sup>3</sup>	Study Design	Sample Characteristics	Measures	Results
1. Studies measuring empathy.  a. C&A samples.	Barriga, Sullivan-Cosetti, and Gibbs (2009).	1	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Delinquent (i.e., individuals court-mandated to attend an empathy training programme).</p> <p><b>Sampling technique:</b> Purposive.</p> <p><b>Sample size:</b> <math>n = 78</math>.</p> <p><b>Sample demographics (TBI):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 83% male, 17% female.</li> <li>• <i>Mean age (SD):</i> 16.9 (1.76) years.</li> <li>• <i>Ethnicity:</i> Caucasian (87%), African American (9%), Mixed race (3%), Latino (1%).</li> <li>• <i>Mean SES (SD):</i> Not reported.</li> </ul>	<p><b>MR measure:</b> SRM-SF.</p> <p><b>Empathy measure:</b> IRI.</p> <p><b>Additional relevant measure:</b> HIT (cognitive distortions and social desirability); GSA (moral identity).</p>	<p><b>Statistical analysis technique(s):</b> Correlation, multiple regression.</p> <p><b>Results for correlation:</b> There were significant positive correlations with medium effect sizes between MR and overall empathy (<math>r = .35, p &lt; .01</math>), affective empathy (<math>r = .34, p &lt; .01</math>), and cognitive empathy (<math>r = .30, p &lt; .05</math>).</p> <p><b>Results for multiple regression:</b> MR was independently associated with empathy (<math>\beta = .26, p &lt; .05</math>) when controlling for cognitive distortions, social desirability and moral identity. Cognitive distortions and moral identity accounted for 30% of the total variance in empathy, after controlling for the confounding effect of social desirability.</p>
	Beauchamp, Dooley, and Anderson (2013).	2	Cross-section.	<p><b>Place of study:</b> Canada.</p> <p><b>Sample type:</b> Clinical (i.e., TBI) and HC groups.</p> <p><b>Sampling technique:</b> Unknown for TBI group (not reported where recruited from); convenience for HCs (recruited from schools).</p> <p><b>Sample size:</b> <math>n = 91</math> (<math>n = 25</math> TBI group; <math>n = 66</math> HC group).</p> <p><b>Sample demographics (TBI):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> Mild TBI 67% male, 33% female; Moderate-Severe TBI 43%</li> </ul>	<p><b>MR measure:</b> So-Moral, So-Mature.</p> <p><b>Empathy measure:</b> IECA.</p>	<p><b>Statistical analysis technique(s):</b> Correlation, ANOVA, multiple regression.</p> <p><b>Results for correlation:</b> There was a significant positive correlation with a medium effect size between MR and empathy (<math>r = .26, p = .02</math>). There was a significant positive correlation with a large effect size between MR and the total number of moral responses provided (<math>r = .48, p &lt; .001</math>). There was a significant positive correlation with a large effect size between MR and IQ (<math>r = .78, p = .01</math>).</p> <p><b>Results for ANOVA:</b> IQ and empathy explained 11.7% of the variance in MR, <math>F(2,90) = 5.28, p = .007</math>.</p> <p><b>Results for multiple regression:</b> Both empathy (<math>\beta =</math></p>

<sup>2</sup> Abbreviations are explained and authors of all tests are presented at the end of Table 2.

<sup>3</sup> Studies have been allocated a number so that they can be referenced in the qualitative evaluation of the studies.

			<p>male, 57% female.</p> <ul style="list-style-type: none"> <li>• <i>Mean age (SD)</i>: Mild TBI 13.16 (1.25) years; Moderate-severe TBI 13.79 (2.43) years.</li> <li>• <i>Ethnicity</i>: Measured but not reported</li> <li>• <i>Mean SES (SD)</i>: Mild TBI 1.39 (0.50); Moderate-Severe TBI 1.17 (0.41).</li> <li>• <i>TBI severity</i>: Mild TBI <math>n = 18</math> (GCS 13-15, some alteration in consciousness, no mass lesion or neurological defects); <math>n = 7</math> Moderate-Severe TBI (GCS 3-12, significant alteration in consciousness, and/or mass lesion and/or neurological impairment).</li> </ul> <p><b>Sample demographics (HC):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 41% male, 59% female.</li> <li>• <i>Mean age (SD)</i>: 13.95 (1.27) years.</li> <li>• <i>Ethnicity</i>: Measured but not reported.</li> <li>• <i>Mean SES (SD)</i>: 1.48 (1.67).</li> </ul>	.25, $p = .02$ ; 6.10%) and IQ ( $\beta = .22$ , $p = .05$ ; 4.58%) made a significant unique contribution to MR.	
Chandler and Moran (1990).	3	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Delinquent (i.e., outpatients in a juvenile justice system) and non-delinquent (i.e., school children).</p> <p><b>Sampling technique:</b> Purposive.</p> <p><b>Sample size:</b> <math>n = 80</math> (<math>n = 60</math> delinquents; <math>n = 20</math> non-delinquents).</p> <p><b>Sample demographics (delinquents):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Age range</i>: 14-17 years (mean and SD not reported).</li> <li>• <i>Ethnicity</i>: Measured but not reported.</li> <li>• <i>Mean SES (SD)</i>: Measured but not reported.</li> </ul> <p><b>Sample demographics (non-delinquents):</b></p> <ul style="list-style-type: none"> <li>• Non-delinquents were matched to delinquents on age, race, education, and SES.</li> </ul>	<p><b>MR measure:</b> MJJ.</p> <p><b>Empathy measure:</b> 31 items from the CPI, 25 items from the MMPI, and 6 items from the IPAR.</p> <p><b>Additional relevant measures:</b> Selman's Stages of Interpersonal Awareness (social perspective taking); Shipley Institute of Living Scale (intelligence).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results for correlation:</b> There were significant positive correlations with large effect sizes between MR and social perspective taking in delinquents (<math>r = .50</math>, <math>p &lt; .001</math>) and non-delinquents (<math>r = .54</math>, <math>p &lt; .01</math>). There was no significant correlation between MR and empathy in delinquents (<math>r = .17</math>, <math>p &gt; .05</math>) and non-delinquents (<math>r = .31</math>, <math>p &gt; .05</math>).</p>
Humphries,	4	Cross-section.	<p><b>Place of study:</b> USA.</p>	<p><b>MR measure:</b> SRM-SF.</p>	<p><b>Statistical analysis technique(s):</b> Correlation,</p>

Parker, and Jagers (2000).	<p><b>Sample type:</b> Non-clinical, specific ethnic group (i.e., African American school children).</p> <p><b>Sampling technique:</b> Convenience (recruited from public elementary schools).</p> <p><b>Sample size:</b> <math>n = 90</math> (<math>n = 44</math> fifth graders, <math>n = 46</math> eighth graders).</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 43% male, 57% female.</li> <li>• <i>Mean age (SD):</i> 11.86 (1.62) years.</li> <li>• <i>Ethnicity:</i> African American (100%).</li> <li>• <i>SES:</i> 90% were eligible for free/reduced price lunch.</li> </ul>	<p><b>Empathy measure:</b> IRI (only the empathic concern and social perspective taking subtests, i.e., cognitive and affective empathy).</p>	<p>ANOVA and multiple regression.</p> <p><b>Results from correlation:</b> Across the whole sample, there was no significant correlation between empathy and MR (results not presented). Gender specific correlations were performed. There was a significant positive correlation with a medium effect size between empathy and MR in boys (<math>r = .38</math>, <math>p &lt; .05</math>), however, there was no relationship between MR and empathy in girls (<math>r = -.09</math>, <math>p =</math> not reported).</p> <p><b>Results from ANOVA:</b> There was no significant main effect of gender on MR, <math>F(1,89) = 3.79</math>, <math>p &gt; .05</math>. There was a significant main effect of age on MR, <math>F(1,89) = 26.21</math>, <math>p &lt; .01</math> with eighth graders' MR skills being significantly higher than that of fifth graders.</p> <p><b>Results from multiple regression:</b> Empathy was a significant predictor of MR in boys (<math>\beta = .35</math>, <math>p &lt; .05</math>) but not in girls (<math>\beta = -.10</math>, <math>p =</math> not reported). Grade was a significant predictor of MR for both boys (<math>\beta = .45</math>, <math>p &lt; .01</math>) and girls (<math>\beta = .52</math>, <math>p &lt; .01</math>). Grade level explained a significant proportion of the variance in MR in boys (<math>R = .45</math>, <math>R^2 = .20</math>, <math>p &lt; .01</math>) and girls (<math>R = .52</math>, <math>R^2 = .27</math>, <math>p &lt; .001</math>).</p>
Kalliopuska (1983).	<p>5</p> <p>Cross-section.</p> <p><b>Place of study:</b> Finland.</p> <p><b>Sample type:</b> Non-clinical (i.e., school children).</p> <p><b>Sampling technique:</b> Unknown (not reported where recruited from).</p> <p><b>Sample size:</b> <math>n = 342</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 49% male, 51% female.</li> <li>• <i>Mean age (SD):</i> Not reported, however age range was 9-12 years.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> </ul>	<p><b>MR measure:</b> Kohlberg's dilemmas.</p> <p><b>Empathy measure:</b> QMEE (emotional empathy).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results:</b> Emotional empathy had a significant positive correlation with MR with medium effect sizes in 10 year old girls (<math>r(66) = .39</math>, <math>p = .01</math>), 10 year old boys (<math>r(52) = .35</math>, <math>p = .02</math>), 11 year old boys (<math>r(57) = .30</math>, <math>p = .04</math>), and 12 year old girls (<math>r(23) = .42</math>, <math>p =</math> not reported). The results for 9 year old boys and girls, 11 year old girls and 12 year old boys were not reported.</p>
Lardén, Melin, Holst, and Langström (2006).	<p>6</p> <p>Cross-section.</p> <p><b>Place of study:</b> Sweden.</p> <p><b>Sample type:</b> Delinquent (i.e., adolescents with antisocial behaviour and co-occurring substance abuse) and non-</p>	<p><b>MR measure:</b> SRM-SF.</p> <p><b>Empathy measure:</b> IECA.</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results:</b> There was a significant positive correlation with a medium effect size between MR and empathy (<math>r = .34</math>, <math>p &lt; .001</math>). However, this reduced to a small non-</p>

				delinquent (i.e., school adolescents) groups.	<b>Additional relevant measure:</b> HIT (cognitive distortions).	significant effect size when the confounding effect of cognitive distortions was removed ( $r = .14, p > .05$ ).	
				<p><b>Sampling technique:</b> Purposive (delinquents recruited from government youth homes, and non-delinquents recruited from schools in rural and urban areas of Sweden).</p> <p><b>Sample size:</b> <math>n = 116</math> (<math>n = 58</math> delinquents; <math>n = 58</math> non-delinquents).</p> <p><b>Sample demographics (delinquents):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 50% male, 50% female.</li> <li>• <i>Mean age (SD):</i> Males – 15.45 (1.4) years; Females – 16.00 (1.4) years.</li> <li>• <i>Ethnicity:</i> 39.7% were born abroad or had at least one parent who was not Swedish.</li> <li>• <i>SES:</i> Measured but not reported.</li> </ul> <p><b>Sample demographics (non-delinquents):</b> Non-delinquents were matched to delinquents by age, gender, ethnic background and SES.</p>			
b. Adult samples.	Aridag and Yuksel (2010).	7	Cross-section.	<p><b>Place of study:</b> Turkey. In this paper, the results of two studies were presented together.</p> <p><b>Sample type:</b> Both non-clinical (i.e., university students).</p> <p><b>Sampling technique:</b> Convenience (recruited from universities).</p> <p><b>Sample size:</b> <math>n = 129</math> (sample 1); <math>n = 435</math> (sample 2).</p> <p><b>Sample demographics (sample 1):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 47% male; 53% female.</li> <li>• <i>Mean age (SD):</i> 22.85 (not reported).</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> </ul> <p><b>Sample demographics (sample 2):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 32% male; 68% female.</li> <li>• <i>Mean age (SD):</i> 22.30 (not reported).</li> </ul>	<p><b>MR measure:</b> MJT.</p> <p><b>Empathy measure:</b> IRI and ESS.</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results:</b> No significant relationships were found between MR and empathy using the IRI or the ESS (results not presented).</p>	

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Kalle and Suls (1978).	8	Cross-section.	<ul style="list-style-type: none"> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> </ul> <p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Non-clinical (i.e., university students).</p> <p><b>Sampling technique:</b> Convenience (recruited from universities).</p> <p><b>Sample size:</b> <math>n = 90</math> (<math>n = 83</math> included in data analysis).</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Mean age (SD)</i>: Not reported.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> </ul>	<b>MR measure:</b> DIT.	<b>Statistical analysis technique(s):</b> Correlation.
Langdon, Murphy, Clare, Steverson, and Palmer (2011).	9	Cross-section.	<p><b>Place of study:</b> UK.</p> <p><b>Sample type:</b> 4 groups (i.e., offenders with and without an ID, and non-offenders with and without an ID). Individuals classified as having an ID had an IQ &lt; 70 in association with difficulties in adaptive behaviour with onset before 18 years of age. Offenders were classified as having at least one Crown Court conviction leading to a custodial sentence.</p> <p><b>Sampling technique:</b> Purposive (ID non-forensic recruited from day services; ID forensic from medium secure hospitals; non-ID non-forensic from non-academic staff in UK universities; non-ID forensic from National Probation Service).</p> <p><b>Sample size:</b> <math>n = 80</math> (<math>n = 20</math> in each group).</p> <p><b>Sample demographics ID non-forensic:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Mean age (SD)</i>: 45.35 (16.57) years.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> </ul>	<b>MR measure:</b> SRM-SF.	<b>Statistical analysis technique(s):</b> Correlation, bootstrapping for mediation.
				<b>Empathy measure:</b> QEEM (emotional empathy).	<p><b>Results:</b> Stage 4 MR was significantly positively correlated with a medium effect size with emotional empathy (<math>r = .28, p &lt; .05</math>).</p> <p>Stage 2, 3 and 5/6 MR were not significantly correlated with emotional empathy (<math>r = .09, -.03, .28, -.01</math> respectively, <math>p =</math> not reported).</p>
				<b>Additional relevant measure:</b> HIT (cognitive distortions).	<p><b>Results for correlation:</b> There was a significant positive correlation with a medium effect size between MR and empathy, <math>r(80) = .33, p = .002</math>.</p> <p>There was a significant negative correlation with a medium effect size between MR and cognitive distortions, <math>r(80) = -.43, p &lt; .001</math>.</p> <p>There was a significant negative correlation with a medium effect size between empathy and cognitive distortions, <math>r(80) = -.25, p = .025</math>.</p>
					<p><b>Results for bootstrapping for mediation:</b> Empathy significantly predicted MR (<math>p = .002</math>). Empathy significantly predicted cognitive distortions (<math>p = .025</math>). MR significantly predicted cognitive distortions, controlling for empathy (<math>p = .001</math>). This indirect effect was significant (<math>z = -2.37, p = .018</math>); This was confirmed using bootstrapping (95% bias-corrected and accelerated bootstrap confidence intervals = <math>-.06</math> to <math>-.01</math>). This suggests that MR mediates the relationship between empathy and distorted cognitions.</p>

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			<ul style="list-style-type: none"> <li>• <i>Mean IQ (SD)</i>: 58.8 (5.87).</li> </ul> <p><b>Sample demographics ID forensic:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Mean age (SD)</i>: 33.6 (7.54) years.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> <li>• <i>Mean IQ (SD)</i>: 62.9 (5.22).</li> </ul> <p><b>Sample demographics non-ID non-forensic:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Mean age (SD)</i>: 38.7 (12.9) years.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> <li>• <i>Mean IQ (SD)</i>: 103.25 (5.7).</li> </ul> <p><b>Sample demographics non-ID forensic:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 100% male.</li> <li>• <i>Mean age (SD)</i>: 38.8 (15.2) years.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> <li>• <i>Mean IQ (SD)</i>: 89.5 (11.12).</li> </ul>		
Mann and Cheng (2013).	10	Cross-section.	<p><b>Place of study:</b> China.</p> <p><b>Sample type:</b> Non-clinical (i.e., university students).</p> <p><b>Sampling technique:</b> Convenience (recruited from university campuses).</p> <p><b>Sample size:</b> <math>n = 150</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 47% male, 53% female.</li> <li>• <i>Mean age (SD)</i>: 23.9 (5.6) years.</li> <li>• <i>Ethnicity</i>: 99% Chinese, 1% other.</li> <li>• <i>SES</i>: Not reported.</li> </ul>	<p><b>MR measure:</b> MJT.</p> <p><b>Empathy measure:</b> QMEE (emotional empathy).</p>	<p><b>Statistical analysis technique(s):</b> Correlation, multiple regression.</p> <p><b>Results for correlation:</b> There were non-significant correlations between MR and emotional empathy (<math>r = -.04</math>, <math>p =</math> not reported).</p> <p><b>Results for multiple regression:</b> Gender, emotional empathy and vertical collectivism (a cultural variable) explained 9% of the variance in MR, which was significant (<math>R^2 = .09</math>, <math>F_{6,147} = 2.24</math>, <math>p &lt; .05</math>). Emotional empathy did not significantly predict MR (<math>\beta = -.47</math>, <math>p =</math> not reported).</p>
Myyrya, Juujärvi, and Pessa (2010).	11	Cross-section.	<p><b>Place of study:</b> Finland.</p> <p><b>Sample type:</b> Non-clinical (i.e., university students).</p> <p><b>Sampling technique:</b> Convenience (recruited from university campuses).</p>	<p><b>MR measure:</b> DIT.</p> <p><b>Empathy measure:</b> IRI (empathic concern and social perspective taking subtests only).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results for correlation:</b> There were significant correlations with small effect sizes between:</p> <ul style="list-style-type: none"> <li>• Maintaining norms score (representing stage 4 MR) and empathic concern (<math>r = -.15</math>, <math>p &lt; .01</math>). This was a negative correlation.</li> </ul>

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				<p><b>Sample size:</b> <math>n = 599</math> in final analysis (<math>n = 792</math> recruited).</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 26% male, 74% female.</li> <li>• <i>Mean age (SD):</i> 23.9 (6.5) years.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> </ul>	<ul style="list-style-type: none"> <li>• Post-conventional MR and empathic concern (<math>r = .22, p = .01</math>). This was a positive correlation.</li> <li>• Personal interests score (representing stage 2 and 3 MR) and perspective taking (<math>r = -.13, p &lt; .01</math>). This was a negative correlation.</li> <li>• Maintaining norms score (representing stage 4 MR) and perspective taking (<math>r = -.12, p &lt; .01</math>). This was a negative correlation.</li> <li>• Post-conventional MR and perspective taking (<math>r = .22, p &lt; .01</math>). This was a positive correlation.</li> </ul>	
	Self, Gopalakrishnan, Kiser, and Olivarez (1995).	12	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Non-clinical (i.e., first year medical students).</p> <p><b>Sampling technique:</b> Purposive (i.e., medical students, recruited from medical schools).</p> <p><b>Sample size:</b> <math>n = 40</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 58% male, 42% female.</li> <li>• <i>Mean age (SD):</i> Not reported.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> </ul>	<p><b>MR measure:</b> DIT.</p> <p><b>Empathy measure:</b> IRI (i.e., cognitive and affective empathy).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results:</b> A significant correlation was found between MR and the fantasy domain of the empathy measure (<math>r = \text{not reported}, p \leq .0411</math>). However, when the data were adjusted for gender, there was no correlation between MR and the fantasy subscale (data not reported).</p> <p>There was no correlation between MR and the empathic concern, personal distress or perspective taking domains of the empathy measure (data not reported).</p>
2. Studies measuring additional affective processes.  a. C&A samples.	Ruma and Mosher (1967).	13	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Delinquent (i.e., in custody of juvenile services).</p> <p><b>Sampling technique:</b> Purposive (recruited from juvenile services).</p> <p><b>Sample size:</b> <math>n = 36</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 100% male.</li> <li>• <i>Age range:</i> 15-17 years (mean and SD not reported).</li> <li>• <i>Ethnicity:</i> Not reported.</li> </ul>	<p><b>MR measure:</b> Kohlberg's dilemmas.</p> <p><b>Guilt measure:</b> Mosher guilt scale (content analysis, global clinical rating, a measure of speech disturbance and total guilt).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results for correlation:</b> Significant positive correlations with large effect sizes were found between MR maturity and guilt:</p> <ul style="list-style-type: none"> <li>• As measured by content analysis (<math>r = .47, p &lt; .01</math>).</li> <li>• As measured by global clinical rating (<math>r = .43, p &lt; .01</math>).</li> <li>• Total guilt (<math>r = .55, p &lt; .01</math>).</li> </ul> <p>No significant correlation was found between MR maturity and guilt as measured by speech disturbance (<math>r = .01, p &gt; .05</math>).</p>

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<p>3. Studies measuring EF.</p> <p>a. C&amp;A samples.</p>	<p>Vera-Estay, Dooley, and Beauchamp (2015).</p>	<p>14</p>	<p>Cross-section.</p>	<ul style="list-style-type: none"> <li>• <i>SES</i>: Majority were low SES status.</li> </ul> <p><b>Place of study:</b> Canada and USA.</p> <p><b>Sample type:</b> Non-clinical (i.e., school adolescents).</p> <p><b>Sampling technique:</b> Convenience (recruited from high schools and colleges in Canada).</p> <p><b>Sample size:</b> <math>n = 92</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: 36% male, 64% female.</li> <li>• <i>Mean age (SD)</i>: 16.36 (2.16) years</li> <li>• <i>Ethnicity</i>: Caucasian (82%), Hispanic (5.4%), Asian (4.3%), Arabic (4.3%), Black (3.3%).</li> <li>• <i>SES</i>: Majority middle class backgrounds.</li> </ul>	<p><b>MR measure:</b> So-Moral, So-Mature.</p> <p><b>EF measure:</b> 5 tasks from the DKEFS (colour-word interference test, trial making test, tower test, 20 questions test, verbal fluency test).</p> <p><b>Additional relevant measures:</b> WASI (IQ); Blishen socio-economic index (SES).</p>	<p><b>Statistical analysis technique(s):</b> Correlation, multiple regression.</p> <p><b>Results for correlation:</b> Significant positive correlations were found between MR maturity and:</p> <ul style="list-style-type: none"> <li>• IQ, with a large effect size (<math>r = .48, p &lt; .001</math>).</li> <li>• Verbal IQ, with a large effect size (<math>r = .44, p &lt; .001</math>).</li> <li>• Non-verbal IQ, with a medium effect size (<math>r = .27, p &lt; .05</math>).</li> <li>• Conceptual reasoning, with a medium effect size (<math>r = .25, p &lt; .001</math>).</li> <li>• Verbal cognitive flexibility, with a medium effect size (<math>r = .31, p &lt; .001</math>).</li> <li>• Non-verbal cognitive flexibility, with a medium effect size (<math>r = .28, p &lt; .001</math>).</li> <li>• Verbal fluency, with a large effect size (<math>r = .47, p &lt; .001</math>).</li> <li>• Feedback utilisation, with a medium effect size (<math>r = .25, p &lt; .05</math>).</li> <li>• Moral decision making, with a medium effect size (<math>r = .26, p &lt; .05</math>).</li> </ul> <p>No significant correlations were found between MR maturity and:</p> <ul style="list-style-type: none"> <li>• Cognitive inhibition (<math>r = .06, p &gt; .05</math>).</li> <li>• Planning (<math>r = .07, p &gt; .05</math>).</li> <li>• SES (results not presented).</li> </ul> <p><b>Results for multiple regression:</b> Together, age and EFs (i.e., conceptual reasoning, cognitive flexibility, verbal fluency and feedback utilisation) explained 31% of the variability in MR maturity, whilst controlling for IQ. The effect size was large (<math>f^2 = .67</math>).</p> <p>When investigating the specific impact of EFs on MR maturity, EFs (i.e., conceptual reasoning, cognitive flexibility, verbal fluency and feedback utilisation) explained 13% of the variability in MR maturity, whilst controlling for age and IQ. The effect size was medium (<math>f^2 = .27</math>).</p> <p>In the final regression model:</p> <ul style="list-style-type: none"> <li>• Age was the strongest predictor of MR maturity (<math>\beta = .39, p &lt; .001</math>).</li> <li>• Together, age and IQ significantly predicted MR maturity (<math>\Delta R^2 = .41, p &lt; .001</math>).</li> <li>• Non-verbal cognitive flexibility significantly predicted MR maturity independently (<math>\beta = .27, p &lt; .001</math>).</li> <li>• Verbal fluency significantly predicted MR maturity</li> </ul>
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				independently ( $\beta = .23, p < .05$ ).		
b. Adult samples.	Anderson, Bechara, Damasio, Tranel, and Damasio (1999).	15	Case study design.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Clinical.</p> <p><b>Sampling technique:</b> Purposive (not reported where recruited from).</p> <p><b>Sample size:</b> <math>n = 2</math>.</p> <p><b>Case 'A':</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> Female.</li> <li>• <i>Age:</i> 20.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> <li>• <i>Brain injury:</i> Pre-frontal cortex lesion following road traffic accident at 15 months.</li> </ul> <p><b>Case 'B':</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> Male.</li> <li>• <i>Age:</i> 23.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> <li>• <i>Brain injury:</i> Pre-frontal cortex lesion following surgery to remove right frontal tumour at 3 months.</li> </ul>	<p><b>MR measure:</b> SIMJ.</p> <p><b>EF measures:</b> IGT, RAVLT, JLO, CFT, WRAT-R, COWA, WCST, TOH.</p> <p><b>Additional relevant measures:</b> WAIS-R (IQ); OTT, ACT, MEPS (assessment of social knowledge)</p>	<p><b>Statistical analysis technique(s):</b> N/A.</p> <p><b>Results:</b> Both cases had intact IQ. Both cases had significant impairments in MR (i.e., they were reasoning at a pre-conventional stage, which is normally associated with 10 year olds). Both cases had significant impairments in EFs (i.e., impaired planning, executing multi-step procedures, using contingencies to guide behaviour, decision-making based upon immediate reward and no consideration of long-term consequences) and impaired social knowledge (i.e., generating appropriate responses to social situations, reasoning through social dilemmas).</p>
	Cottone, Drucker, and Javier (2007).	16	Cross-section.	<p><b>Place of study:</b> USA and Jamaica.</p> <p><b>Sample type:</b> Non-clinical select religious group.</p> <p><b>Sampling technique:</b> Purposive (i.e., a select religious group, recruited from undergraduate and postgraduate students in a Catholic university).</p> <p><b>Sample size:</b> <math>n = 128</math> (complete data for <math>n = 119</math>).</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 35% male, 65% female.</li> <li>• <i>Mean age (SD):</i> 24.58 (11.4) years.</li> <li>• <i>Ethnicity:</i> Measured but not reported.</li> <li>• <i>SES:</i> Not reported.</li> </ul>	<p><b>MR measure:</b> DIT2.</p> <p><b>EF measures:</b> Stroop test (cognitive flexibility/inhibition), similarities test of the WASI-III (abstract reasoning), comprehension test of the WASI-III (social awareness and general reasoning).</p>	<p><b>Statistical analysis technique(s):</b> Correlation, multiple regression.</p> <p><b>Results for correlation analysis:</b> There was a significant positive correlation between MR and cognitive flexibility/inhibition with a medium effect size (<math>r = .20, p &lt; .05</math>). There was a significant positive correlation between MR and abstract reasoning with a large effect size (<math>r = .53, p &lt; .001</math>). There was a significant positive correlation between MR and social awareness and general reasoning with a medium effect size (<math>r = .51, p &lt; .001</math>).</p> <p><b>Results for multiple regression:</b> In step one of a sequential regression, demographic predictors (i.e., age, gender, grade point average, number of college semesters) predicted a significant amount of the</p>

			<ul style="list-style-type: none"> <li>• <i>Religious orientation</i>: 100% Christian (76% Catholic, 24% Protestant).</li> </ul>		<p>variance in MR (<math>R^2 = .17</math>, <math>F_{inc}(4, 119) = 5.88</math>, <math>p &lt; .001</math>). Adding EFs led to a significant change in <math>R^2</math>, (<math>\Delta R^2 = .21</math>, <math>\Delta F(3, 116) = 12.67</math>, <math>p &lt; .001</math>), and the omnibus model remained significant (<math>R^2 = .37</math>, <math>F_{inc}(7, 116) = 9.77</math>, <math>p &lt; .001</math>).</p>
Grattan and Eslinger (1992).	17	Case study design.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Clinical.</p> <p><b>Sampling technique:</b> Purposive (not reported where recruited from).</p> <p><b>Sample size:</b> <math>n = 1</math>.</p> <p><b>Case 'DT':</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: Female.</li> <li>• <i>Age</i>: 33.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> <li>• <i>Brain injury</i>: Focal frontal lobe lesion at 7 years.</li> </ul>	<p><b>MR measure:</b> MJJ.</p> <p><b>Cognitive empathy:</b> Empathy Measure (self and parent report).</p> <p><b>EF measures:</b> Benton laboratory comprehensive examination.</p>	<p><b>Statistical analysis technique(s):</b> N/A.</p> <p><b>Results:</b> Patient DT had a very low score on both self and parent reports of empathy (total = 27). Patient DT had impaired MR (MR at a level normally associated with 10-13 years). Patient DT had impairments in EFs, including impairments in: (1) sustained attention and concentration; (2) cognitive flexibility; (3) planning and regulation of goal-directed activity; (4) environmental judgments.</p>
Travis, Harung, and Lagrosen (2011).	18	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Non-clinical (i.e., musicians).</p> <p><b>Sampling technique:</b> Purposive (recruited from professional and amateur orchestras).</p> <p><b>Sample size:</b> <math>n = 50</math> (<math>n = 25</math> professional musicians, <math>n = 25</math> amateur musicians).</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender</i>: The two groups were matched for gender, 52% male, 48% female in each group.</li> <li>• <i>Age</i>: The two groups were matched for age, <math>40.0 \pm 9.5</math> and <math>40.5 \pm 10.3</math>, range 27-63 years.</li> <li>• <i>Ethnicity</i>: Not reported.</li> <li>• <i>SES</i>: Not reported.</li> </ul>	<p><b>MR measure:</b> SRM-SF.</p> <p><b>EF measure:</b> Stroop test ("frontal EFs").</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results for correlation analysis:</b> There was a significant negative correlation with a medium effect size between MR maturity and reaction time on the Stroop interference test (<math>r = -.26</math>, <math>p &lt; .01</math>), i.e., individuals with higher MR maturity had faster resolution of response conflict during this test. There was no significant correlation between MR and reaction time on the word trials, i.e., a measure of processing speed (<math>r = .28</math>, <math>p &gt; .05</math>). There was no significant correlation between MR and age (<math>r = .15</math>, <math>p &gt; .05</math>).</p>
Wain and	19	Cross-	<b>Place of study:</b> USA.	<b>MR measure:</b> SRM-SF.	<b>Statistical analysis technique(s):</b> Correlation.

Spinella (2007).	section.	<p><b>Sample type:</b> Non-clinical.</p> <p><b>Sampling technique:</b> Convenience (recruited from word of mouth in university campuses and the local community).</p> <p><b>Sample size:</b> <math>n = 213</math>.</p> <p><b>Sample demographics:</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 33% male, 67% female.</li> <li>• <i>Mean age (SD):</i> 28.0 (11.9) years.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> <li>• <i>Mean formal education (SD):</i> 14.8 (1.6) years.</li> <li>• <i>Religious affiliation:</i> Christian (70.9%), Atheist/Agnostic (8.9%), Wicca (0.9%), Hindu (0.9%), Muslim (0.9%), other (11.3%), unknown (2.3%).</li> </ul>	<b>EF measure:</b> EFI.	<p><b>Results for correlation analysis:</b> Significant positive correlations were found between MR maturity and EFs:</p> <ul style="list-style-type: none"> <li>• Motivational drive with a medium effect size (<math>r = .25</math>, <math>p &lt; .01</math>).</li> <li>• Impulse control with a medium effect size (<math>r = .29</math>, <math>p &lt; .01</math>).</li> <li>• Empathy with a large effect size (<math>r = .54</math>, <math>p &lt; .01</math>).</li> <li>• Organization with a medium effect size (<math>r = .21</math>, <math>p &lt; .05</math>).</li> <li>• Strategic planning with a medium effect size (<math>r = .31</math>, <math>p &lt; .01</math>).</li> <li>• Total EF with a large effect size (<math>r = .52</math>, <math>p &lt; .01</math>).</li> </ul> <p>Partial correlations controlling for sex, age and education (<math>df = 208</math>) demonstrated similar effective sizes between MR maturity and EFs:</p> <ul style="list-style-type: none"> <li>• Motivational drive with a medium effect size (<math>r = .24</math>, <math>p &lt; .01</math>).</li> <li>• Impulse control with a medium effect size (<math>r = .24</math>, <math>p &lt; .01</math>).</li> <li>• Empathy with a large effect size (<math>r = .51</math>, <math>p &lt; .01</math>).</li> <li>• Organization with a medium effect size (<math>r = .18</math>, <math>p &lt; .05</math>).</li> <li>• Strategic planning with a medium effect size (<math>r = .32</math>, <math>p &lt; .001</math>).</li> <li>• Total EF with a large effect size (<math>r = .49</math>, <math>p &lt; .01</math>).</li> </ul>		
4. Studies measuring EFs and affective processes.  a. C&A samples.	Lee and Prentice (1988).	20	Cross-section.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Delinquent.</p> <p><b>Sampling technique:</b> Purposive (delinquents recruited from juvenile corrective facilities, and matched HCs recruited from high schools).</p> <p><b>Sample size:</b> <math>n = 54</math> (<math>n = 36</math> delinquents, <math>n = 18</math> non-delinquents).</p> <p><b>Sample demographics (both samples matched):</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> 100% male.</li> <li>• <i>Mean age (SD):</i> 16.05 (not reported).</li> <li>• <i>Ethnicity:</i> Caucasian (40%), Black (40%), American Mexican (30%).</li> <li>• <i>SES:</i> Not reported.</li> </ul>	<p><b>MR measure:</b> Kohlberg's moral dilemmas.</p> <p><b>Empathy measures:</b> QMEE, IRI (i.e., cognitive and affective empathy).</p> <p><b>Social role taking measure:</b> Modified version of the Nickel and Dime Game.</p> <p><b>EF measure:</b> Pendulum task and balance task (logical thinking).</p>	<p><b>Statistical analysis technique(s):</b> Correlation.</p> <p><b>Results for correlation analysis:</b> Correlations between MR and empathy (using both empathy measures) were non-significant (<math>r</math> ranged from <math>-.21</math> to <math>.12</math>, <math>p &gt; .05</math>).</p> <p>A significant positive correlation with a large effect size was found between role-taking stage and MR (<math>r = .51</math>, <math>p = .001</math>).</p> <p>A significant positive correlation with a large effect size was found between logical thinking and MR on the balance (<math>r = .51</math>, <math>p &lt; .01</math>) and pendulum (<math>r = .39</math>, <math>p &lt; .005</math>) tasks. This remained when the effect of verbal ability was partialled out: MR and role-taking (<math>r = .45</math>, <math>p &lt; .001</math>), MR and pendulum task (<math>r = .62</math>, <math>p &lt; .001</math>), MR and balance task (<math>r = .36</math>, <math>p &lt; .005</math>).</p> <p>When role-taking was partialled out, there was no significant correlation between MR and logical thinking for the pendulum (<math>r = .10</math>, <math>p &gt; .10</math>) or balance (<math>r = .21</math>, <math>p &lt; .10</math>) tasks.</p>

b. Adult samples.	Price, Daffner, Stowe, and Mesulam (1990).	21	Case study design.	<p><b>Place of study:</b> USA.</p> <p><b>Sample type:</b> Clinical.</p> <p><b>Sampling technique:</b> Purposive (not reported where recruited from).</p> <p><b>Sample size:</b> <math>n = 2</math>.</p> <p><b>Case 'GK':</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> Male.</li> <li>• <i>Age:</i> 28.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> <li>• <i>Brain injury:</i> Severe bilateral prefrontal damage present from birth.</li> </ul> <p><b>Case 'MH':</b></p> <ul style="list-style-type: none"> <li>• <i>Gender:</i> Female.</li> <li>• <i>Age:</i> 34.</li> <li>• <i>Ethnicity:</i> Not reported.</li> <li>• <i>SES:</i> Not reported.</li> <li>• <i>Brain injury:</i> Severe bilateral prefrontal damage present from 4 years of age.</li> </ul>	<p><b>MR measure:</b> Kohlberg's moral dilemmas.</p> <p><b>Empathy task:</b> Task where the participant must consider the perspective of an individual lost in the countryside.</p> <p><b>EF measures:</b> TMT, Stroop test, WCST, Luria hand-motor sequence, auditory go no-go task, visual verbal test, word list generation, visuoverbal and proverb interpretation test.</p> <p><b>Additional relevant measure:</b> WASI</p>	<p>When logical thinking was partialled out, the significant positive correlation between MR and role-taking remained on the pendulum (<math>r = .37, p &lt; .005</math>) and balance (<math>r = .44, p &lt; .001</math>) tasks.</p> <p><b>Statistical analysis technique(s):</b> N/A.</p> <p><b>Results:</b> Both cases had impaired MR (i.e., reasoning at a pre-conventional level). Both cases had significant behavioural disruptions, and had little sense of remorse, empathy, or fairness towards others, and instead felt victimised by others. Both cases had impairments in EFs, however, the profile varied. Case GK had intact IQ (102), and had severe impairments in some EFs (attention, organisation and mental flexibility), however, not in others (i.e., case GK had intact abstraction). Case MH had moderate impairments in some EFs (i.e., mental flexibility, sustained effort and abstract reasoning) and a slight impairment in attention.</p>
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*Note.* Analysis of variance (ANOVA); child and adolescent (C&A); executive functioning (EF); Glasgow comma scale (GCS); healthy control (HC); intraclass correlation coefficient (ICC); intellectual disability (ID); moral reasoning (MR); United Kingdom (UK); United States of America (USA); socioeconomic status (SES); standard deviation (SD); traumatic brain injury (TBI). *Measure abbreviations and authors:* ACT = awareness of consequences test (Platt & Spivack, 1975); Auditory go no-go task (Luria, 1973); Benton laboratory comprehensive examination (no reference provided); Blishen socioeconomic index (Blishen, Carroll, & Moore, 1987); CFT = Complex figure test (Lezak, 1995); COWA = Controlled oral word association (Lezak, 1995); CPI = California personality inventory (Hogan & Busch, 1984); DIT/DIT2 = defining issues test/defining issues test-second edition (Rest, Cooper, Coder, Masanz, & Anderson, 1974; Rest & Narvaez, 1998); DKEFS = Delis-Kaplan executive function system (Delis, Kaplan, & Kramer, 2001); EFI = Executive functioning index (Spinella, 2005); Empathy measure (Hogan, 1969); Empathy task (Flavell, 1968); ESS = Empathic skill scale (Dokmen, 1990); GSA = Adapted Good Self Assessment (Arnold, 1993); HIT = how I think questionnaire (Barriga & Gibbs, 1996); IECA = index of empathy for children and adolescents (Bryant, 1982); IGT = Iowa gambling task (Bechara, Damasio, Damasio, & Anderson, 1994); IPAR = Institute of personality assessment and research (Hogan & Busch, 1984); IRI = interpersonal reactivity index (Davis, 1983); JLO = Judgment of line orientation (Lezak, 1995); Kohlberg's moral dilemmas (Kohlberg et al., 1982); Luria hand-motor sequence (Luria, 1973); MEPS = means-ends problem solving procedure (Platt & Spivack, 1975); MJJ = moral judgment interview (Kohlberg, 1969); MJT = moral judgment test (Lind, 1998); MMPI = Minnesota multiphasic personality inventory (Hogan & Busch, 1984); Nickel and dime game (Flavell, Botkin, Fry, Wright, & Jarvis, 1968); OTT = optional thinking test (Platt & Spivack, 1975); Pendulum and balance task (Inhelder & Piaget, 1958); PVG = Portrait value questionnaire (Schwartz, Lehmann, & Roccas, 1999); QMEE = questionnaire measure of emotional empathy (Mehrabian & Epstein, 1972); RAVLT = Rey auditory verbal learning test (Lezak, 1995); Selman's stages of interpersonal awareness (Selman, 1980, 1981); Shipley institute of living scale (Zachary, 1986); SIMJ = Standard issue moral judgment test (Colby & Kohlberg, 1987); So-Moral, So-Mature (Dooley et al., 2010); SRI = Social risk index (Roberts et al., 2008); SRM-SF = Sociomoral reflection measure (Gibbs, Basinger, & Fuller, 1992); Stroop colour-word task (Golden, 1978); Stroop interference task (Stroop, 1935); TMT = Trial making test (Reitan, 1958); TOH = Tower of Hanoi (Lezak, 1995); Visual verbal test (Feldman & Drasgow, 1959); Visuoverbal and proverb interpretation test (Feldman & Drasgow, 1959); WART-R = Wide range achievement test-revised (Lezak, 1995); WASI = Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999); WCST = Wisconsin card sorting test (Berg, 1948); Word list generation (Benton & Hamsher, 1976).

## Summary of Findings

This review aimed to critically evaluate the empirical evidence considering which cognitive (i.e., EF, cognitive empathy) and affective (i.e., affective empathy, ToM, emotion processing/recognition) processes are associated with MR. The review found more consistent evidence for a positive association between cognitive processes (i.e., EF) and MR as opposed to cognitive/affective empathy, ToM and emotion processing/recognition. The literature examined by this review, however, did not examine causal relationships between cognitive/affective processes and MR, and the methodological quality of studies was generally poor, which weakens the overall strength of the evidence for the role of cognitive/affective processes in MR.

**Relationships between EFs and MR.** As shown in Table 2, EFs (cognitive flexibility, conceptual reasoning, verbal fluency, feedback utilisation, abstract reasoning, social awareness, impulse control, strategic planning, motivational drive, and organisation) were positively associated with MR with medium to large effect sizes in non-clinical adolescent/adult samples<sup>(14,16,18-20)</sup>. Case studies<sup>(15,17,21)</sup> also revealed joint impairments in MR and EFs (logical thinking, mental flexibility, attention, sustained effort, abstract reasoning, planning, executing multi-step procedures, social decision-making, and generating appropriate responses to social situations) in individuals with brain injury.

**Relationships between affective processes and MR.** Results for empathy were inconsistent. Empathy was positively associated with MR with small to large effect sizes in some child, adult, and clinical/delinquent populations<sup>(1,2,9,11)</sup>. Three studies in non-clinical populations<sup>(5,8,12)</sup> found a



positive relationship in certain genders/ages, or in post-conventional MR only. One study of delinquents<sup>(6)</sup> found a medium effect size between MR and empathy, however, the relationship was no longer significant when controlling for cognitive distortions. Six studies in non-clinical/delinquent samples<sup>(3,4,7,10,12,20)</sup> found no relationship between MR and empathy. One case study<sup>(21)</sup> revealed joint impairments in MR and empathy in individuals with brain injury. One study<sup>(13)</sup> found a positive association between guilt and MR in delinquent adolescent males.

### **Critical Appraisal**

Study findings need to be considered in light of each study's limitations. Using the EBL checklist (Table 3), two studies were rated as "high" quality<sup>(9,14)</sup>, eleven were rated as "moderate" quality<sup>(1-4,6,10,11,13,16,18,19)</sup>, and eight as "low" quality<sup>(5,7,8,12,15,17,20,21)</sup>. Less weight should be given to the findings from low quality studies<sup>(5,7,8,12,15,17,20,21)</sup>.

Table 3

*Critical appraisal of included studies using the EBL checklist*

Study	EBL Critical appraisal					Quality rating
	Population (%)	Data collection (%)	Study design (%)	Results (%)	Overall (%)	
Anderson et al. (1999)	0.0	40.0	60.0	50.0	37.5	Low
Aridag and Yuksel (2010)	20.0	40.0	40.0	40.0	30.0	Low
Barriga et al. (2009)	20.0	60.0	80.0	60.0	55.0	Moderate
Beauchamp et al. (2013)	50.0	40.0	60.0	83.3	58.3	Moderate
Cottone et al. (2007)	33.3	60.0	80.0	50.0	55.8	Moderate
Chandler and Moran (1990)	40.0	60.0	40.0	40.0	45.0	Moderate
Grattan and Eslinger (1992)	0.0	25.0	60.0	50.0	33.8	Low
Humphries et al. (2000)	33.3	60.0	80.0	66.7	60.0	Moderate
Kalle and Suls (1978)	0.0	60.0	60.0	40.0	38.1	Low
Kalliopuska (1983)	0.0	40.0	20.0	16.7	19.1	Low
Langdon et al. (2011)	50.0	80.0	80.0	83.3	73.3	High
Lardén et al. (2006)	66.7	60.0	100.0	50.0	69.2	Moderate
Lee and Prentice (1988)	0.0	40.0	40.0	50.0	32.5	Low
Mann and Cheng (2013)	16.7	40.0	60.0	50.0	41.7	Moderate
Myrya et al. (2010)	20.0	60.0	60.0	40.0	45.0	Moderate
Price et al. (1990)	0.0	40.0	60.0	25.0	31.3	Low
Ruma and Mosher (1967)	20.0	60.0	40.0	80.0	50.0	Moderate
Self et al. (1995)	0.0	40.0	60.0	33.3	25.1	Low
Travis et al. (2011)	16.7	60.0	80.0	83.3	60.0	Moderate
Vera-Estay et al. (2015)	50.0	60.0	100.0	83.3	73.3	High
Wain and Spinella (2007)	33.3	60.0	60.0	66.6	55.0	Moderate

Note: Low (overall score <40%); moderate (40-70%); high (>70%), based upon the method of Amini et al. (2011).

**Design.** There were three case studies<sup>(15,17,21)</sup> and 18 cross-sectional correlation studies<sup>(1-14,16,18-20)</sup>. Although the case studies allowed for in-depth exploration of individuals with well-defined pathology, their findings are difficult to generalise to wider populations. As all 21 studies captured measurements at a single time-point, causation cannot be inferred, which limits the understandings of which cognitive and affective processes underpin MR.

**Sample.** Due to the convenience and purposive sampling techniques employed by all studies, they are not fully representative of, or generalisable, to the wider populations they represent. Studies had heterogeneous target populations, and five studies<sup>(4,10,12,16,18)</sup> recruited participants based on characteristics not relevant for the review research question (i.e., cultural/profession variables, religious orientation, and gender). Thirteen studies<sup>(1,3-5,7,8,10-12,16,18-20)</sup> did not define their inclusion/exclusion criteria, and did not exclude participants on variables known to influence the relationship between cognitive/affective processing and MR (e.g., psychiatric, neurological and developmental comorbidities). These differing characteristics may mean that study results are confounded by additional, unmeasured variables.

Sample sizes ranged from 1-599. Cottone et al. (2007) was the only study that performed a power calculation to determine whether their sample size was adequate to detect the expected effect size in the population. In the remaining studies, power was calculated retrospectively for the purpose of the EBL checklist, using the recommendations of Cohen (1992) for a medium effect size. Studies which had adequate power by this method<sup>(1,2,9,11)</sup> more often found an association between MR and empathy than those which did not<sup>(3-5,8,12,20)</sup>. It is possible, therefore, that studies which did not find an association between MR and empathy lacked statistical power.

### **Measures.**

**MR measures.** Seventeen of the 21 studies<sup>(1-7,9,10,13-15,17-21)</sup> used production measures of MR. Production measures are more accurate at measuring MR and its underlying processes than recognition measures, because individuals must describe their arguments and understanding of

emotional states (Stams et al., 2006; van Vugt et al., 2011). Nine studies<sup>(5,7,14,15,17,19-21)</sup> that used production measures did not report inter-rater reliability, therefore, it is not clear whether the MR measures were reliably scored in these studies.

Fifteen of the 21 studies<sup>(2-3,5,7-8,10-17,20-21)</sup> utilised MR measures based upon Kohlberg's theory of MR. These measures have been criticised as coding is complex, and dilemmas lack ecological validity as they present quintessential moral dilemmas that most individuals will not have experienced (Dooley et al., 2010). Kohlberg's theory of MR has also been widely criticised. For example, longitudinal studies have found that few participants reach the final stage (postconventional MR; e.g., Colby et al., 1983), prompting the suggestion that this stage may reflect liberal-conservative political ideology rather than MR (Emler, Resnick, & Malone, 1983). Consequently, the findings of Cottone et al. (2007) may not reflect MR, as they only examined postconventional MR.

Two studies<sup>(2,14)</sup> used the So-Moral and So-Mature measures, which are computerised production measures developed to assess MR in adolescents (Dooley et al., 2010). Dooley et al. claim that the use of visual stimuli enhances emotional involvement, improving ecological validity. As there is reduced reliance on cognitive processing (e.g., reading), they further propose that the measure has advantages when used in adolescent and clinical populations, as was done by Beauchamp et al. (2013) and Vera-Estay et al. (2015). The measures are limited, however, as they are based upon Kohlberg's outdated theory of MR. Furthermore, their psychometric properties have only been tested in a small cross-sectional sample (Dooley et al., 2010). Construct validity using

factor analysis should be examined in larger samples over time to assess concurrent validity of the measures.

Six studies<sup>(1,4,6,9,18,19)</sup> used the SRM-SF. This is a favoured production measure, as it has good validity, high internal consistency, high test-retest reliability and has exhibited cross cultural validity in diverse age groups, and clinical/delinquent populations (Gibbs et al., 2007).

***Measures assessing affective processes.*** As shown in Table 3, studies which demonstrated a relationship between MR and empathy tended to be of higher methodological quality<sup>(2,6,9)</sup> than those who did not<sup>(3,5,8,10,12,20)</sup>, based upon the EBL checklist.

Thirteen studies<sup>(1-12,20)</sup> utilised self-report measures of empathy. Such measures are limited as they are influenced by additional variables including demand characteristics and social desirability (Lovett & Sheffield, 2007). Furthermore, accuracy is dependent upon the individual's honesty, self-awareness, and ability to differentiate between related emotional states, such as sympathy (de Wied et al., 2007; Vossen, Piotrowski, & Valkenburg, 2015). In child samples, parent reports can overcome some of these limitations, however, these were only included by Grattan and Eslinger (1992).

Three studies<sup>(1-12,20)</sup> utilising adolescent and ID populations used the IECA. As the IECA was designed to measure emotional empathy in youth, the choice of measure was appropriate, and all these studies found an association between MR and empathy. The QMEE and IRI were both validated with university students. This calls into question their usefulness in child/adolescent,

and clinical samples (Jolliffe & Farrington, 2004), and three child studies<sup>(4,5,20)</sup> using these measures did not find an association between MR and empathy.

All of the empathy measures utilised by the studies included in this review, however, have been criticised as they measure other factors in addition to empathy. For example, the IECA additionally measures emotion knowledge (de Wied et al., 2007; Del Barrio, Aluja, & Garcia, 2004), and the QMEE measures emotional arousal to the environment in general, as opposed to empathic states specifically (Mehrabian, Young, & Sato, 1988).

**EF measures.** Most studies used performance measures of EF, which have stronger internal validity, control over confounding variables, and allow for examination of different EFs when compared to self-report measures (Gioia, Isquith, & Kenealy, 2011). As self-reports and performance measures of EF are thought to measure different underlying mental constructs (Toplak, West, & Stanovich, 2013), the findings from the study that utilised a self-report measure (Wain & Spinella, 2007) may not be comparable with the other studies that utilised performance measures. All studies that examined EFs, however, found positive associations between EFs and MR, despite the quality of these studies ranging from low to high, based upon the EBL checklist.

Many EF measures have uncertain validity because they involve demanding and multifaceted tasks that measure both executive and non-executive processes (Ogilvie, Stewart, Chan, & Shum, 2011). For this reason, neuropsychological batteries of EF are considered the most reliable measures of EF, as used by four studies<sup>(14,15,17,21)</sup>. Cottone et al. (2007) used measures of crystallised intelligence to assess EF. It is not known the degree to which these capture EF, which weakens these findings.

**Statistical analyses.** Most studies did not provide evidence that they tested parametric assumptions, making it difficult to infer whether their statistical techniques were appropriate. Most studies did not perform corrections for multiple statistical testing, increasing the probability of type I errors.

All studies that performed statistical analysis utilised correlation, which only demonstrates simple associations between variables and does not allow us to infer causality. Six studies<sup>(1,2,4,10,14,16)</sup> employed multiple regression, which permitted comparison of the contribution of several predictor variables. Langdon et al. (2011) utilised a more advanced statistical technique (mediation modelling), and performed bootstrapping, which enables an accurate determination of statistical significance via confidence intervals (Preacher & Hayes, 2004, 2008). Confidence in this mediation model is limited, however, by the study's cross-section design, as causality cannot be inferred.

Studies investigating MR should account for the influence of age during moral development, and consider the roles of SES and intelligence, as these are known confounding variables (Stams et al., 2006). Six studies<sup>(2,3,6,9,14,20)</sup> controlled for these variables in the design or data analysis. Three studies<sup>(2,4,14)</sup> using child samples did not control for age (Beauchamp & Anderson, 2010; Humphries et al., 2000; Vera-Estay et al., 2015), which reduces confidence in their findings.

## Discussion

This structured review aimed to critically evaluate empirical research investigating the association between EFs, empathy, ToM, and emotion processing/recognition, and MR. The literature suggests that EFs are associated with MR, with some clinical studies further demonstrating

impairments in both EFs and MR (e.g., following TBI). Studies examining the relationship between empathy and MR were inconsistent, with some demonstrating a relationship in child, adult, and delinquent/clinical samples, while others did not. These mixed findings could be related to the methodological quality of studies, as studies of higher quality tended to find a positive association between MR and empathy, whereas those of lower quality did not. In delinquent individuals there was an association between low empathy and self-serving cognitive distortions, which was mediated by MR. This suggests that MR is not only influenced by cognitive and affective processing, but MR may also drive relationships between cognitive and affective processes. One study demonstrated a positive association between MR and guilt in delinquent male youths, providing tentative evidence for an association between emotion experience and MR. No studies included in this review investigated the relationship between MR and ToM.

### **Review Implications**

**Clinical implications.** The research summarised suggests that the empirical evidence for cognitive and affective processes underpinning MR is insufficient. This limits our understanding of the mechanisms underpinning MR, and, furthermore, limits the validity of MR theories. This has clinical implications, because gaining a better understanding of MR and its underlying processes could allow insight to improve current interventions aimed at reducing offending, and also could allow for the development of targeted programmes to foster moral resilience in youth. Evidence suggests that impairments in MR can occur as a result of a number of different clinical conditions, which are also associated with impaired cognitive and affective processing, including TBI (Beauchamp et



al., 2013) and IDs (Langdon et al., 2010). A better understanding of the inter-relationships between cognitive and affective processing and MR might, therefore, lead to the improved characterisation of impairments (i.e., valid and reliable assessment measures), which in turn might lead to more targeted and effective interventions. For example, the Equipping Youth to Help One Another Programme (EQUIP) is currently the only intervention that targets MR. EQUIP has been found to improve MR and reduce antisocial behaviour/recidivism in some (Leeman, Gibbs, & Fuller, 1993; Nas, Brugman, & Koops, 2005) but not all (Brusten, Stams, & Gibbs, 2007) studies. If future research demonstrates a causal association between EF skills and MR development, then adapting EQUIP to include EF skills training might improve its effectiveness at advancing MR skills, and reducing antisocial behaviour and recidivism.

**Future research.** The methodological shortcomings of studies included in this review lead to several recommendations for future research. For example, research employing longitudinal designs is required to understand moral *development*. Such research could recruit young children and follow them into emerging adulthood to assess the relative contribution of cognitive and affective processes at different stages of moral development. Longitudinal designs could be utilised in conjunction with sophisticated data analysis techniques to infer causal relationships, such as structural equation modelling, mediation, and moderation analysis.

This review highlighted that few or no studies have investigated the association between emotion processing/recognition and ToM in MR. This perhaps reflects the measures used to assess MR. Studies used MR measures based upon traditional theories of MR (i.e., Kohlberg, Gibbs). Such measures

may be biased in showing an association between cognitive processes and MR, as they require high-level top-down control to respond to dilemmas (Sachdeva, Singh, & Medin, 2011). Other researchers utilising forced-choice MJ measures and neuroimaging techniques have previously provided evidence for an association between MR and emotion (e.g., Decety, Michalska, & Kinzler, 2012). Such studies were excluded as they are not necessarily representative of MR (see Introduction). Future studies could use experimental designs where emotion is manipulated through the induction of mood states (e.g., guilt, sadness), and assess the effect on MR. Studies could additionally utilise populations vulnerable to deficits in ToM and emotion processing/recognition, such as individuals with autism or TBI. Furthermore, more measures using visual dilemmas could be developed to increase ecological validity, as such measures involve emotion processing (e.g., face processing) in the interpretation of stimuli. Studies utilising virtual reality software are additionally beginning to show promise for investigating affective processes associated with MR (Patil, Cogoni, Zangrando, Chittaro, & Silani, 2014).

As results for empathy were inconsistent, more studies of higher methodological quality (e.g., longitudinal design, high statistical power) should investigate the relationship between MR and empathy. As empathy is a complex, multifaceted construct, studies may benefit from using a range of measures to encapsulate empathy and overcome the limits of self-report. This could include behavioural measures, such as the Multifaceted Empathy Test (Dziobek et al., 2008), or an emotion tracing tool to measure empathic accuracy (Zaki, Bolger, & Ochsner, 2008).

This review revealed that cognitive and affective processes only accounted for small amounts of variance in MR, suggesting that additional factors are involved in MR. Importantly, these factors are not currently considered by MR theories, suggesting that research is needed to refine and develop MR theories. Currently, well-established theories of MR (see Introduction) can be criticised for failing to comprehensively account for situational and socially relevant factors. For example, Vera-Estay et al. (2015) found that both verbal and non-verbal EFs are associated with MR, which indicates that visual cues may be associated with MR. To embrace this complexity, theories of MR could be updated to include ideas from social information processing theory (SIT; Crick & Dodge, 1994). SIT explains how mental operations are deployed to produce a behavioural response during social interactions. Future research could utilise SIT alongside MR theories, which may provide information concerning *how* MR influences behaviour in relation to cognitive and affective processing. This would be helpful in understanding the range of complex human behaviours MR is known to influence. Research with adolescents may be particularly informative. Adolescence marks a vulnerable developmental period for the emergence of socially inappropriate behaviours due to changes in brain development and social contexts in this time (Blakemore & Mills, 2014; Steinberg, 2008). Immature EFs or empathy in adolescence, therefore, may affect social functioning and MR, which could result in inappropriate social behaviour (Vera-Estay et al., 2015).

### **Limitations of the Review**

The findings of this review should be considered in light of its limitations. Specifically, the search criteria may have excluded relevant studies, as they did not include unpublished or non-English language literature.

### **Conclusions**

In conclusion, there is preliminary evidence to suggest that EFs are positively associated with MR. Findings for the relationship between empathy and MR are inconsistent, which may relate to methodological quality of the studies. Future research should overcome the limitations of current studies, for example, by utilising longitudinal designs, highly powered samples, and investigating affective processing. The findings of this review suggest that there is a need to revise theories of MR to more fully represent the complexity of factors (e.g., EFs, affective processes, situational variables) that interact in MR. Such research could utilise SIT to understand how these processes interact to influence behaviour.

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## Appendices

### Appendix A: Glossary of terms

**Abstract reasoning:** The application of past experiences to be able to reason about novel, broader and abstract principles individuals may not have encountered (Markovits & Doyon, 2010).

**Cognitive flexibility:** The ability to simultaneously consider multiple concepts and switch between tasks (Martin & Rubin, 1995).

**Cognitive inhibition:** The ability to suppress distracting stimuli that is irrelevant for task completion (Serrien & Sovijärvi-Spapé, 2013).

**Empathy:** A continuum of skills which comprise both cognitive and affective processes. Cognitive empathy describes the ability to intellectually understand others' emotional states alongside situational cues, whereas affective empathy is the ability to have an emotional response to the emotional state of another that is congruent with their situation as opposed to one's own situation (i.e., "emotional contagion"; Baron-Cohen & Wheelwright, 2004; Cohen & Strayer, 1996; Watt, 2007). In addition, empathy involves motivational components (i.e., empathic concern), which relates to the urge of caring for the welfare of another (Decety & Cowell, 2014).

**Emotion processing:** The ability to identify and interpret the affective states (e.g., guilt, despair, happiness, sadness) of others and one's self (Völlm et al., 2006). This includes diverse socio-cognitive skills such as face processing, interpretation of body cues and emotion attributions.

**Executive functioning:** A range of higher order integrating and converging cognitive processes that are activated in a situation-specific manner to allow individuals to organise, evaluate and modify their thoughts and behaviours to achieve future goals in the light of complex and novel situations (Hughes, 2011). Examples are cognitive flexibility/inhibition, working memory, and abstract reasoning (also defined in this appendix).

**Intuition:** A decision that occurs suddenly and automatically without conscious processing (Haidt, 2001).

**Moral domain:** This is one of the three domains of social knowledge, and represents knowledge concerning issues of justice, welfare, human rights and fairness (Turiel, 1983).

**Moral judgment:** This reflects a decision made within the moral domain, for example, whether a situation is morally right or wrong (Moll et al., 2005).

**Moral reasoning:** This reflects the cognitive and affective processing that occurs when an individual is making a moral judgment (Moll et al., 2005).

**Theory of mind:** An umbrella term of skills that comprises of cognitive and affective processes which allow individuals to infer the beliefs and motivations of others (“cognitive theory of mind”) and to infer what another individual is feeling (“affective theory of mind”);Shamay-Tsoory et al., 2010).

**Working memory:** The mental ability to temporarily store and manipulate information (Alloway & Alloway, 2010).

**Appendix B: Data Extraction Form****Data Extraction Form****Title:****Author(s):****Journal:****Year of publication:****Volume:****Pages:****Aims(s) of study:****Study design:****Population.****Place of study:****Sample type (clinical/non-clinical/delinquent):****Sampling technique:****Sample size:****Power calculation: Y/N Outcome:****Sample demographics:**

- *Gender:*
- *Mean age (SD):*
- *Ethnicity:*
- *SES:*
- *Any specific information related to clinical/delinquent characteristics:*



**Inclusion criteria specified?: Y/N**

**Details:**

**Exclusion criteria specified?: Y/N**

**Details:**

### **Measures.**

**Specify MR measure used:**

**Production/recognition measure?:**

**Which theory of MR based upon?:**

**Specify additional measures used:**

**Were additional measured validated?:**

### **Results.**

**Specify statistical analysis techniques:**

**Were statistical analysis techniques clearly described?:**

**Was there evidence that parametric assumptions had been tested?:**

**Were statistical analysis techniques appropriate in relation to the research questions and research design?:**

**If applicable, were appropriate corrections made for multiple statistical tests?:**

**Was there adequate reporting of results? (Or biased reporting of results, e.g., selective outcome reporting?):**

**Study results:**

### **Conclusion.**

**Study conclusions:**

**Were conclusions appropriate?**

**Study strengths:**

**Study limitations:**

**Possible sources of bias:**

## Appendix C: The EBL Checklist

EBL Critical Appraisal Checklist		Yes (Y)	No (N)	Unclear (U)	N/A
Section A: Population	Is the study population representative of all users, actual and eligible, who might be included in the study?				
	Are inclusion and exclusion criteria definitively outlined?				
	Is the sample size large enough for sufficiently precise estimates?				
	Is the response rate large enough for sufficiently precise estimates?				
	Is the choice of population bias-free?				
	If a comparative study: Were participants randomized into groups? Were the groups comparable at baseline? If groups were not comparable at baseline, was incomparability addressed by the authors in the analysis?				
	Was informed consent obtained?				
	Section B: Data Collection	Are data collection methods clearly described?			
If a face-to-face survey, were inter-observer and intra-observer bias reduced?					
Is the data collection instrument validated?					
If based on regularly collected statistics, are the statistics free from subjectivity?					
Does the study measure the outcome at a time appropriate for capturing the intervention's effect?					
Is the instrument included in the publication?					
Are questions posed clearly enough to be able to elicit precise answers?					
Were those involved in data collection not involved in delivering a service to the target population?					
Section C: Study Design	Is the study type / methodology utilized appropriate?				
	Is there face validity?				
	Is the research methodology clearly stated at a level of detail that would allow its replication?				
	Was ethics approval obtained?				
	Are the outcomes clearly stated and discussed in relation to the data collection?				
Section D: Results	Are all the results clearly outlined?				
	Are confounding variables accounted for?				
	Do the conclusions accurately reflect the analysis?				
	Is subset analysis a minor, rather than a major, focus of the article?				
	Are suggestions provided for further areas to research?				
	Is there external validity?				
<b>Calculation for section validity: (Y+N+U=T)</b>  If Y/T <75% or if N+U/T > 25% then you can safely conclude that the section identifies significant omissions and that the study's validity is questionable. It is important to look at the overall validity as well as section validity.		<b>Calculation for overall validity: (Y+N+U=T)</b>  If Y/T ≥75% or if N+U/T ≤ 25% then you can safely conclude that the study is valid.			
<b>Section A validity calculation:</b> <b>Section B validity calculation:</b> <b>Section C validity calculation:</b> <b>Section D validity calculation:</b>		<b>Overall validity calculation:</b>			

EBLIP Critical Appraisal Checklist  
 Lindsay Glynn, MLIS  
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## **Appendix D: Instructions for Authors**

### **British Journal of Psychology**

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**SCHOOL OF PSYCHOLOGY**

**DOCTORATE IN CLINICAL PSYCHOLOGY**

**EMPIRICAL PAPER**

**An Investigation of the Relationships between Executive  
Functioning, Empathy, Moral Reasoning and Behaviour in  
Typically Developing Adolescents**

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**Submitted in partial fulfilment of requirements for the Doctorate Degree in  
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## Abstract

*Objective:* Moral reasoning (MR) reflects rationalisation in the moral domain, which matures across development and is underpinned by cognitive and affective processes. Although MR is associated with offending behaviours the mechanisms for this association are unknown. Examining the role of cognitive and affective processes in MR, and their influence on behaviour, may enhance existing psychological interventions that aim to reduce offending behaviours, and facilitate the development of novel targeted interventions. The current study investigated the hypothesis that MR would mediate the relationship between executive functions (EFs) and behaviour, and between empathy and behaviour.

*Method:* In a cross-sectional design, typically developing adolescents ( $n = 72$ ) individually completed an assessment battery, including the sociomoral reflection measure-short form, neuropsychological measures of working memory and cognitive flexibility/inhibition, and self-report questionnaires of empathy and behaviour. The battery also contained an assessment of intellectual functioning, and obtained data on socioeconomic status and age as confounding variables.

*Results:* MR was not associated with self-report behaviour and, therefore, did not mediate the relationship between EFs/empathy and self-reported behaviour. A novel relationship was demonstrated between working memory and MR, and cognitive flexibility/inhibition was associated with MR. Self-report empathy was not associated with MR. Exploratory analyses suggested that intelligence and EFs were significant unique predictors of MR,

and that truth and law moral values were associated with self-reported behavioural difficulties.

*Conclusions:* Findings suggest that global MR is not associated with self-reported behaviour in typically developing adolescents, however, there may be an association between some moral values and self-reported behaviour. Findings also suggested that empathy is not associated with MR in this population, which warrants further investigation. These findings have implications for theoretical models of MR, and psychological intervention programmes. Recommendations for future research are presented.

**Key words.** *Moral reasoning; empathy; executive functioning; behaviour.*

## Introduction

The moral domain is one domain of social knowledge that concerns issues of justice, equal rights, deliberate harm and welfare (Smetana, 2006). When moral conflicts arise in social interactions, some behaviours are driven by fast, automatic, and emotional reactions in which the individual is alerted to the moral salience of the event (Haidt, 2007; Swedene, 2005). Other moral conflicts, however, require slower, deliberate, conscious evaluation due to competing interests, increased complexity, or potential severe and punitive consequences (Vera-Estay, Dooley, & Beauchamp, 2015). This slower, rational analysis, in which the individual is deciding whether a situation is morally right or wrong, is defined as “moral reasoning” (MR), and the subsequent decision made is termed a “moral judgment” (MJ; Moll, Zahn, Oliveira-Souza, Krueger, & Grafman, 2005). MR differs from other forms of reasoning as it is influenced by an individual’s moral schema (i.e., rules and knowledge in the moral domain) and moral emotions (e.g., empathy and guilt; Killen & Smetana, 2008). Development of MR (“moral development”) begins early in childhood and continues throughout development, driven by dynamic interactions between cognitive and socio-emotional development, which in turn is facilitated by brain maturation and opportunities for social perspective taking (Gibbs, 2014).

MR is a well-established contributor to delinquent, offending, and re-offending behaviours (Stams et al., 2006; van Vugt et al., 2011). MR is suggested to act as an internal dialogue guiding MJs, and can be used in social exchanges to influence others (Vera-Estay et al., 2015). This may be particularly important during adolescence, when an individual’s identity and moral ideologies are forming (Killen & Rutland, 2011), and when the cognitive

and affective processes that underpin MR are developing (Blakemore & Mills, 2014; Gibbs, 2014).

Currently it is not fully understood how MR and its underlying processes might interact and influence behaviour. Investigating these relationships is the aim of this study. This knowledge is important to enhance and better understand the mechanisms of existing psychological MR interventions, such as the Equipping Youth to Help One Another Programme (EQUIP). EQUIP focuses on teaching moral development, pro-social skills and altering pro-aggressive behaviours using a peer-helping approach (Gibbs, Potter, & Goldstein, 1995). EQUIP has been found to reduce antisocial behaviour/recidivism in offenders (Leeman, Gibbs, & Fuller, 1993; Nas, Brugman, & Koops, 2005), individuals with traumatic brain injury (TBI; Manchester et al., 2007) and intellectual disabilities (IDs; Langdon, Murphy, Clare, Palmer, & Rees, 2013), and typically developing adolescents (DiBiase, 2010; van der Velden, Brugman, Boom, & Koops, 2010). EQUIP does not, however, consistently improve MR, and/or reduce behavioural difficulties (Brusten, Stams, & Gibbs, 2007; Leeman et al., 1993; Nas et al., 2005). Understanding how MR affects behaviour may, therefore, enable EQUIP to be adapted to improve its efficiency, and facilitate the development of novel targeted interventions.

### **MR Theories**

Theories differ in the emphasis they place on the relative contribution of cognitive and affective processes underpinning MR (see Appendix A for a glossary of terms discussed in this section). Some theories emphasise the importance of cognitive development (Kohlberg, 1984). Other theories propose



that MJs are intuitive (Haidt, 2001) or primarily driven by empathy (Hoffman, 2000), with MR providing post-hoc justifications that can be verbalised.

Neuroimaging studies, however, have demonstrated that neural circuitry associated with MR involves systems that are associated with cognition *and* emotion (Decety, Michalska, & Kinzler, 2012). Consistent with these findings, Gibbs' sociomoral stage theory (SST; Figure 1) is a theory of cognitive (e.g., moral schema) and affective (e.g., empathy) co-primacy (Gibbs, 2014). Gibbs suggests that mature MR emerges during adolescence, and requires going beyond egotistical rule-based immature MR and instead taking others' perspectives and that of society into account. This process is called decentration, and is hypothesised to occur due to gains in working memory (WM), metacognitive abilities, and through opportunities for social perspective taking.

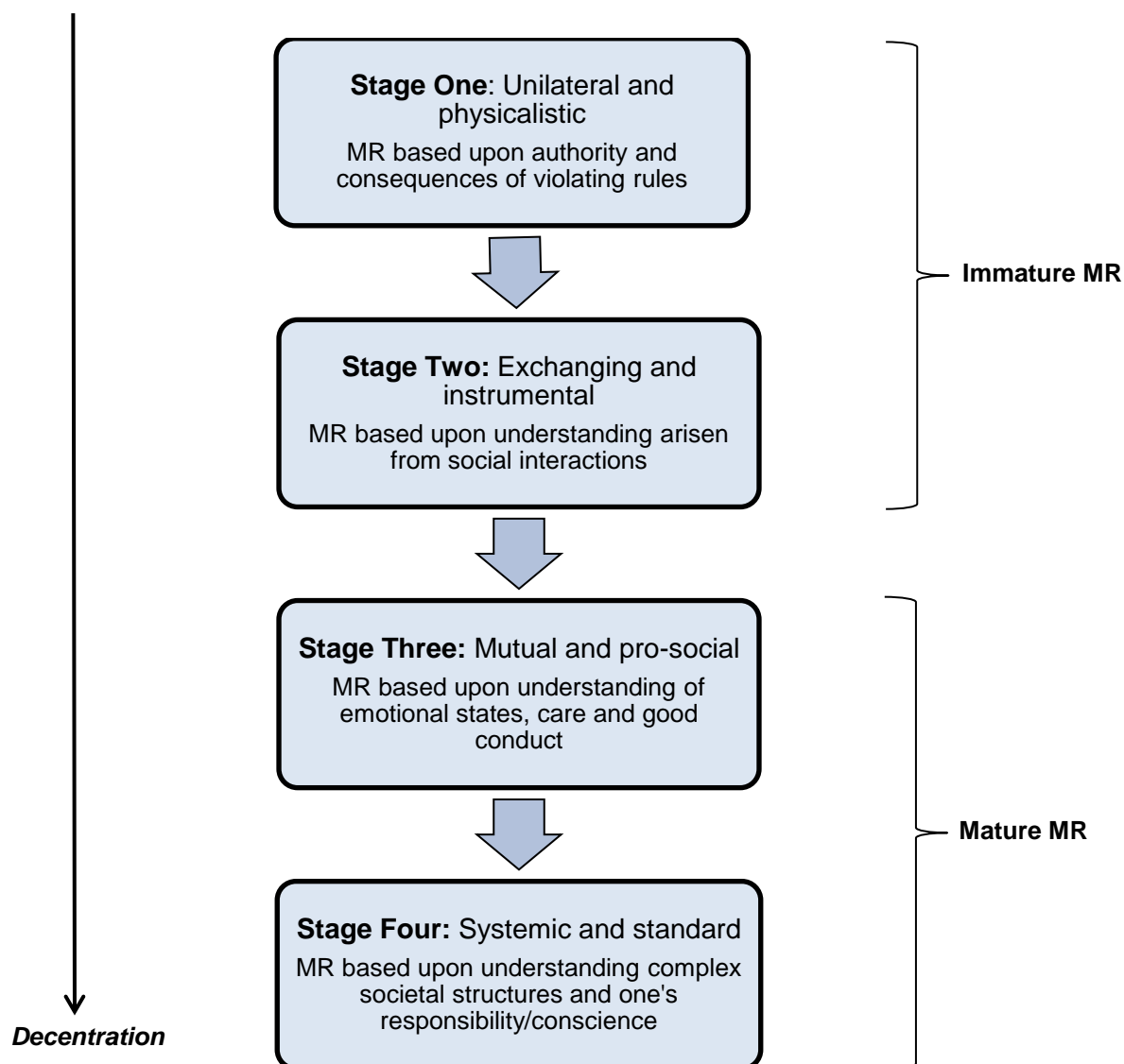


Figure 1. Depiction of stages involved in SST.

### Cognitive and Affective Processes Associated with MR

A positive relationship between MR and intelligence is well-established in typically developing, clinical, and offending populations (McDermott & Langdon, 2014; Stams et al., 2006; van Vugt et al., 2011). Additionally, MR theories hypothesise that higher-order cognitive functions, such as executive functions (EFs), contribute to MR (Colby & Kohlberg, 1987; Gibbs, 2014). EFs, particularly cognitive flexibility/inhibition (CFI) allow individuals to tolerate ambiguity, consider alternatives, and select appropriate moral schemata in response to changing social environments, whilst inhibiting inappropriate

responses (Vera-Estay et al., 2015). Positive associations have been found between MR and CFI, abstract reasoning, verbal fluency, and self-monitoring in typically developing adolescents and adults (Cottone, Drucker, & Javier, 2007; Vera-Estay et al., 2015). Additionally, WM may support other EFs (e.g., planning) to help individuals process and manipulate multiple socially relevant cues, as well as assisting faster cognitive processing (Diamond, 2014b). The relationship between WM and MR has not been investigated empirically, however, evidence suggests that MJs are slowed when individuals are engaged in tasks requiring high cognitive load (an analogue for reducing WM capacity; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008).

Empathy is also required for MR to allow individuals to understand and respond to the emotional states of others, and is considered to be the primary motivator for moral behaviour by Hoffman (2000). Correlations between MR and empathy have been found in ID (Langdon, Murphy, Clare, Steverson, & Palmer, 2011), TBI (Beauchamp, Dooley, & Anderson, 2013), and offending (Barriga, Sullivan-Cosetti, & Gibbs, 2009) populations.

### **Social Information Processing Theory (SIT)**

MR theories fail to explain *how* MR affects behaviour. SIT (Crick & Dodge, 1994) is concerned with how mental operations are deployed to produce a behavioural response during social interactions. The SIT model (Figure 2) consists of six non-sequential processing steps that occur rapidly, in parallel, and with numerous feedback loops (Arsenio & Lemerise, 2004).

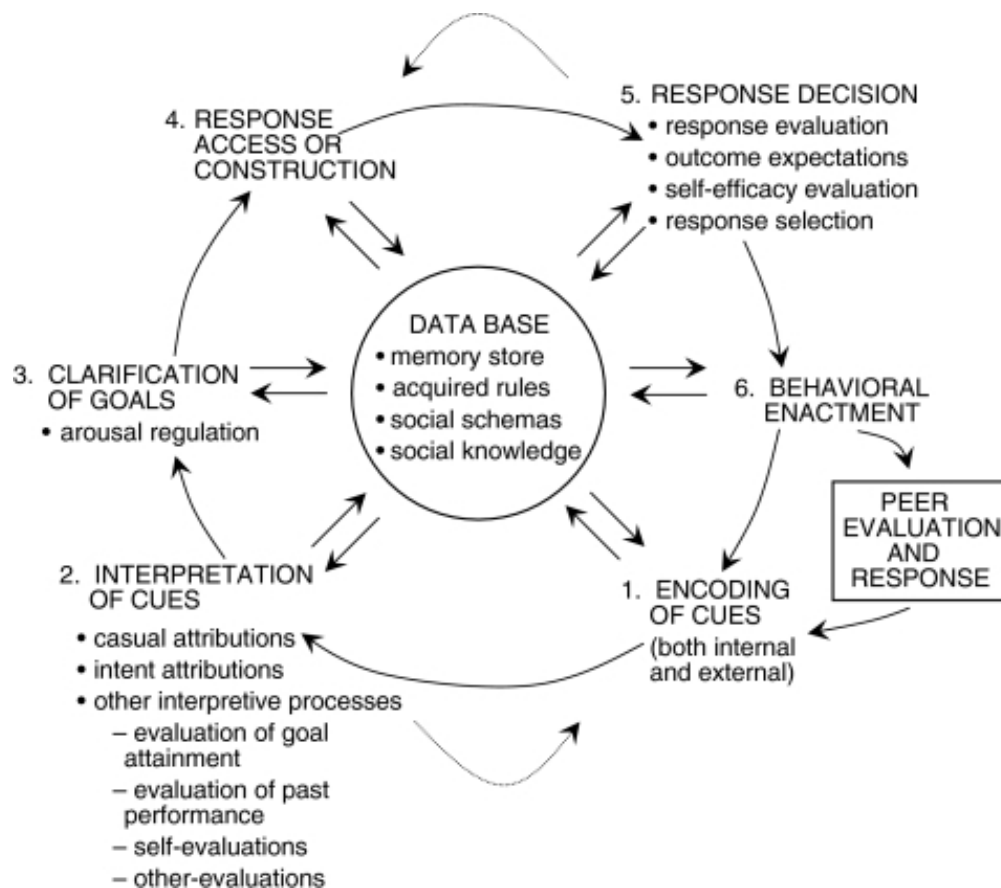


Figure 2. The SIT model. From “A review and reformulation of social-information processing mechanisms in children’s development” by N. Crick, and K. Dodge, 1994, *Psychological Bulletin*, 115, p. 76. Copyright 1994 by the American Psychological Association.

Using the SIT model alongside Gibbs’ theory enables predictions to be made regarding the inter-relationships between MR, EFs, empathy, and behaviour. For example, the “database” in the SIT model could reflect “moral schema”, as in Gibbs’ theory. According to the model, these moral schemata influence each step (e.g., step two: interpretation of social cues, which could rely on empathy; step three: clarification of goals, which could rely on CFI; step five: response decision, which could rely on both empathy and CFI), leading to behavioural enactment. Given the likely role of EFs and empathy in the multiple steps leading to behaviour, SIT might predict that MR mediates the relationship between EFs, empathy, and behaviour.

## **Relationships between MR, EFs, Empathy and Behaviour**

In the context of SIT and MR theories, immature MR characterised by egocentricity and priority towards instrumental gain may bias information processing, leading to behavioural difficulties. Consistent with this, meta-analyses have found moral developmental delay in offending and ID populations (Stams et al., 2006; van Vugt et al., 2011), and MR has been associated with behavioural problems in typically developing adolescents (Bear & Richards, 1981; Bear & Rys, 1994; Richards, Bear, Stewart, & Norman, 1992). Furthermore, as previously mentioned, psychological interventions targeting MR reduce antisocial/offending behaviours in typically developing and offending/clinical populations (DiBiase, 2010; Leeman et al., 1993; Manchester et al., 2007).

Meta-analyses have also identified an association between impaired EF and antisocial behaviour (Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011). It is hypothesised that EF impairments decrease behavioural inhibition and the ability to consider behavioural consequences (e.g., step five in SIT). This can impede the capacity to generate socially appropriate behaviour in novel or changing contexts (e.g., step four in SIT), which can lead to antisocial behaviour (Ogilvie et al., 2011). Lower empathy is associated with behavioural and emotional difficulties in youth (Dadds et al., 2008; de Wied, Goudena, & Matthys, 2005), possibly via step two (interpretation of social cues) and step five (response evaluation) in SIT. Consistent with this, impairments in MR, EF, and empathy found in an adolescent TBI population were proposed as a possible mechanism explaining the increased prevalence of offending in this population (Beauchamp et al., 2013).

## **Factors Contributing to the Relationship between MR and Behaviour**

Age is known to influence the relationship between MR and behaviour due to MR maturation, and increased opportunities to engage in inappropriate behaviours (Vera-Estay et al., 2015). There is also a well-replicated association between less mature MR and lower socioeconomic status (SES; Stams et al., 2006). There are numerous potential, non-mutually exclusive reasons for this association. For example, adequate economic resources and increased parental support in higher SES may buffer the effect of lower MR skills on behavioural difficulties (Stams et al., 2006). Additionally, lower SES has been linked to increased life events and reduced cognitive, social and linguistic stimulation from caregivers, which may have downstream effects on the development of brain structures involved in EF and emotion (Brito & Noble, 2014).

Evidence from adult offending and ID populations has suggested that the relationship between MR and offending may be curvilinear, in the shape of an inverted U-shaped curve, and that intelligence may moderate this relationship (Mears & Cochran, 2013; van Vugt et al., 2011). Individuals with IDs have developmentally immature MR (McDermott & Langdon, 2014). Theoretically, developmentally immature MR that is associated with rule adherence (stage one in SST) may buffer against offending. In contrast, individuals in the middle of the IQ spectrum exhibit MR that places increased emphasis on satisfying personal needs (stage two in SST), which may increase the likelihood of offending. Individuals with higher IQs have MR that has matured beyond egotistical viewpoints (stages three/four in SST), and may also

have increased social and economic advantages, making them less likely to offend (McDermott & Langdon, 2014).

Stams et al. (2006) found that the relationship between MR and delinquency remained significant in their meta-analysis when the influence of age, SES, and intelligence was controlled. Despite this, they highlighted that it is important to consider these covariates when examining the relationship between MR and behaviour.

### **The Significance of Adolescence**

During adolescence, increased social interaction and autonomy provide opportunities for skills in MR to be practiced, refined, and exchanged (Vera-Estay et al., 2015). There is extensive reorganisation in the prefrontal cortex (Arain et al., 2013), which is associated with MR and the cognitive and affective processes thought to underpin MR (Raine & Yang, 2006). In early adolescence, the main neuronal circuitry required for EF has emerged (Crone & Dahl, 2012). Maturation of circuitry (e.g., myelination and synaptogenesis) strengthen these connections across adolescence, and allow for more efficient communication within the fronto-striatal circuits and between the frontal cortex and other regions of the brain (Blakemore & Choudhury, 2006; Khundrakpam et al., 2013; Paus, 2010). Subsequently, during adolescence there are age-related changes in EFs, including WM (Luciana, Conklin, Cooper, & Yarger, 2005), inhibitory control (Luna, Garver, Urban, Lazar, & Sweeney, 2007) and cognitive flexibility (Blakemore & Choudhury, 2006). Advances in perspective taking, affective processing, and EF enhance empathy development across adolescence (Van der Graaff et al., 2014). Improvements in EF and social cognitive processing dynamically interact and influence each other, refining skills in both areas, and

allowing for significant shifts in social perspective taking (Baird, 2008; Blakemore & Mills, 2014). This promotes the emergence of mature MR, as individuals can consider the perspectives of others (Gibbs, 2014).

Considering these issues in combination, it is perhaps unsurprising that adolescence marks a vulnerable period for the development of risk taking and offending behaviours (Blakemore & Robbins, 2012). This life stage is, therefore, of particular interest when examining MR.

### **Research Rationale**

MR is rationalisation in the moral domain, which matures with age and can guide behaviour. Intelligence is known to moderate the relationship between MR and offending. Other processes known to underpin MR, specifically EFs (CFI) and affective processing (empathy) also correlate with behaviour. Despite theoretical models (SST, SIT) predicting a relationship between WM and MR, and more importantly the role of MR as a mediator between EFs and behaviour, and empathy and behaviour, to date no studies have investigated this. Understanding how these variables relate could further enhance the theoretical understanding of MR, potentially leading to more comprehensive assessments of MR, novel targeted interventions, and the enhancement of existing MR interventions (e.g., by including additional aspects of social information processing).

Currently, the development of MR is not well understood (Arsenio & Lemerise, 2010). This limits understanding of the construct of MR, and makes it difficult to understand mechanisms that separate normality and pathology. Early adolescence represents a key life stage to test the predictions of SIT and SST, as it marks a significant developmental shift from immature to mature MR



(Gibbs, 2014), and the constructs to be examined are emerging but are not yet fully operational and mature (De Haan & Gunnar, 2009).

**Research aim.** This research aims to test the relationships between EFs (CFI and WM), empathy, MR, and behaviour in typically developing early adolescents. Investigating mediation allows for an understanding of the mechanism by which a mediating variable influences the relationship between a predictor and an outcome (Hayes, 2013). Based upon the review of the literature, the primary hypotheses are:

1. MR will mediate the relationship between CFI and behaviour.
2. MR will mediate the relationship between WM and behaviour.
3. MR will mediate the relationship between empathy and behaviour.

Due to the aforementioned role of intelligence, age, and SES in the development of MR, and the development and maintenance of behavioural difficulties, these variables will also be measured and controlled for in analyses.

#### **Exploratory analyses.**

***Relative contribution of cognitive and affective processing.*** Theories disagree as to the relative importance of cognitive and affective processing in MR. The data will, therefore, be explored to examine which cognitive and affective processes have a unique relationship with MR when controlling for other cognitive and affective processes.

***Association between sub-domains of MR and behaviour.*** There is some indication that offenders with IDs have lower MR in the law and legal justice sub-domains of MR when compared to non-offenders with IDs (Langdon,

Murphy, Clare, & Palmer, 2010; Langdon et al., 2011; McDermott & Langdon, 2014). MR is also most often associated with externalising (as opposed to internalising) behaviours (Stams et al., 2006; van Vugt et al., 2011). The data will, therefore, be explored to examine the associations between different moral values and specific behavioural difficulties.

***Association with gender.*** Gender differences are not consistently reported in the literature, so were not considered in the study design. Some studies, however, have found that girls reach MR maturity earlier than boys (Stams et al., 2006), and there are gender differences in the development of empathy (Van der Graaff et al., 2014) and behaviour (Mullis, Cornille, Mullis, & Huber, 2004). The data will, therefore, be explored to investigate such differences.

## **Method**

### **Design**

This study used a cross-sectional correlational design. The predictor variables were MR, CFI, WM, and empathy. The outcome variable was self-reported behaviour. Information was collected on known covariates: age, SES, and IQ.

### **Participants**

Inclusion criteria were individuals who: (a) were aged 11-14 years (see Introduction); (b) spoke English as their first language (to ensure they could give informed consent and understand the assessment). Individuals with developmental disorders, history of acquired brain injury, co-morbid mental health disorders and substance misuse were excluded. Such factors are known

to interfere with MR, behaviour, and cognitive and affective processing (Beauchamp et al., 2013), and were considered to be confounders.

**Sample size.** Previous research has found medium to large associations between CFI and MR (Cottone et al., 2007; Vera-Estay et al., 2015), and medium associations between MR and self-reported behaviour (Bear, 1989), and between empathy and MR (Langdon, et al., 2011). The relationship between MR and WM has not been empirically tested. A conservative estimate of this association would be a medium effect.

Using estimates of sample sizes for mediation models to yield power of .80 at an alpha level of .05 when  $\alpha$  and  $\beta$  are a medium effect size, a sample size of 71 was indicated (Fritz & Mackinnon, 2007).

**Recruitment.** Appendix B summarises full recruitment details; recruitment documents are shown in Appendix C. Eighty-five percent ( $n = 61$ ) of participants were recruited from secondary schools in England and Wales, with written consent from the head teachers. Parents/guardians and pupils were provided with information sheets about the study from the school, and were given the opportunity to opt-out of taking part. Fifteen percent ( $n = 11$ ) of participants were recruited via the University of Exeter staff newsletter via an opt-in strategy. Parents/guardians replied to an advert about the study, and were sent information sheets. If their child wanted to take part, parents/guardians gave written consent. In both recruitment methods, written assent was required from participants.

## Measures

Refer to Appendix D for copies of assessments (where copyright permitted).

**Demographics.** The demographics questionnaire requested participants' date of birth, ethnicity, sex and parental occupation. Parental occupation was used to calculate an estimation of SES using the occupational factor of the Four Factor Index of Social Status (Hollingshead, 2011).

**Intellectual functioning.** The vocabulary and matrix reasoning subtests from the Wechsler Abbreviated Scale of Intelligence-Second Edition (WASI-II) (Wechsler, 2011) were used to estimate full scale IQ (FSIQ;  $M = 100$ ,  $SD = 15$ ). The WASI-II has been standardised for use in individuals from 6-89 years. The WASI-II has good internal consistency ( $\alpha = .95$  to  $.97$ ), good validity ( $r = .92$ ) when compared to other IQ measures including the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV), and good test-retest correlation over 12-88 days ( $r = .91$ ) (Wechsler, 2011).

**Empathy.** The Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) is a self-report questionnaire measuring cognitive and affective empathy. It contains 60 items: 40 items measuring empathy, and 20 filler items. Respondents answer items based on a 4-point Likert scale from "definitely disagree" to "definitely agree". Approximately half of the items are reverse-scored. Based on the strength of the empathic response, scores of zero, one, or two are given for each item yielding a total score (maximum score = 80), with higher scores indicating higher empathy. The EQ has good validity (Lawrence, Shaw, Baker, Baron-Cohen & David, 2004), good internal consistency ( $\alpha = .85$ ) and good reliability (Muncer & Ling, 2006), however, it has not been validated

for use in adolescents. It was selected as many adolescent self-report empathy questionnaires do not correspond to recent theoretical models of empathy as they do not capture different components of empathy (Lovett & Sheffield, 2007). Cronbach's  $\alpha$  for the sample was .83, indicating excellent reliability.

To overcome the limitations of self-report, the children's version of the Empathy Quotient (EQ-C; Auyeung et al., 2009) was used to provide a parent report of empathy. The EQ-C also measures cognitive and affective empathy, and is structured, scored and interpreted in the same way as the EQ, however has fewer items (27), and thus yields a lower maximum score (54). The EQ-C has high internal consistency ( $\alpha = .93$ ) and good test-retest reliability over 6 months ( $r = .86$ ; Auyeung et al., 2009). Cronbach's  $\alpha$  for the sample was .85, indicating excellent reliability.

### **Executive functioning.**

***Cognitive flexibility/inhibition.*** The Contingency Naming Test (CNT; Taylor, Albo, Phebus, Sachs, & Bierl, 1987) assesses both simple and multidimensional cognitive shifting behaviour. Participants are required to name shapes and/or colours according to increasingly difficult rules across four tasks: Two baseline naming tasks, a one-dimensional switching task and a two-dimensional switching task. The efficiency score is calculated using total time and errors, and was used as an indicator of CFI as it provides an overall indication of speed/accuracy trade-off, with higher values representing better CFI. The CNT has been found to be sensitive to cognitive development and impairment in children aged 7-18 years (Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001).

**Working memory.** The Automated WM Assessment (AWMA; Alloway, 2007) is a computerised tool for assessing short-term and WM in individuals aged 4-22 years (Alloway, Gathercole, Kirkwood, & Elliott, 2008). As MR was assessed verbally, only the verbal WM tasks (listening recall and backward digit recall) were administered. Verbal WM includes tasks requiring both storage and processing, yielding a composite standard score ( $M = 100$ ,  $SD = 15$ ). The test re-test reliability over 4 weeks for listening recall and backward digit recall are  $r = .81$  and  $.64$  respectively (Alloway et al., 2008; Alloway, Gathercole, & Pickering, 2006).

**Moral reasoning.** The Socio-Moral Reflection Measure-Short Form (SRM-SF; Gibbs et al., 1992) consists of 11 questions concerning moral values that are considered important cross-culturally: contract, truth, affiliation, life, property, law, and legal justice. Respondents are asked to rate each moral question as “very important”, “important”, or “not important”, and to provide justifications. Verbatim answers to these questions are scored according to rules in the manual (Gibbs et al., 1992). For the measure to be valid, at least 7 of the 11 items must be allocated a score. Scores are calculated for each moral value, and these are averaged to produce a global MR stage score, the sociomoral reflection maturity score (SRMS), which relates to moral stage: Stage 1 = 100-125; Transition Stage 1(2) = 126-149; Transition Stage 2(1) = 150-174; Stage 2 = 175-225; Transition Stage 2(3) = 226- 249; Transition Stage 3(2) = 250-274; Stage 3 = 275-325; Transition Stage 3(4) = 326-349; Transition Stage 4(3) = 350-374; Stage 4 = 375-400. SRMS were used in the main analyses, and moral values in the exploratory analyses. The SRM-SF has demonstrated good internal consistency ( $\alpha = .92$ ), test-retest validity over 2-3

weeks ( $r = .88$ ) and has good cross cultural validity (Gibbs et al., 1992; Gibbs, Basinger, Grimec, & Snarey, 2007).

The SRM-SF was administered as an interview to reduce the confounding effect of reading and writing ability. To ensure reliability, the researcher undertook 30 hours of self-training provided and recommended by the SRM-SF manual. An expert rater scored 19% of the data set. Inter-rater reliability was calculated with the two-way mixed effects intraclass correlation coefficient (ICC), and indicated an ICC of  $r = .92$ ,  $p < .001$ . This exceeds the value of  $r = .80$  recommended by Gibbs et al. (1992) in the scoring manual, indicating excellent reliability. All 72 interviews were possible to score. Cronbach's  $\alpha$  was .52, indicating low internal consistency.

**Behaviour.** The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) has 25 items that assess strengths and difficulties in five domains: hyperactivity, conduct problems, emotional symptoms, peer problems, and prosocial behaviour. Scores can be generated for each domain (maximum score = 10), and for total difficulties (TDs; maximum score = 40). Scores for TDs were used in the main analyses, and scores for each domain were used in the exploratory analyses. Both self-report and parent-report versions were used. The parent-report version was included to have a comparison behaviour score to overcome the limits of self-report (Verhulst & van der Ende, 1992). Scores from the SDQ are convergent with independent diagnoses of childhood disorders and other checklist measures (Goodman & Scott, 1999; Goodman, 2001). The TDs score has good internal consistency ( $\alpha = .80$ ) and test-retest reliability over 4-6 months ( $r = .75$ ; Goodman & Scott, 1999; Goodman, 2001). In this study, Cronbach's  $\alpha$  for self-reports were: TDs (.80), emotion (.72),

conduct (.63), hyperactivity (.76), peer (.39) and prosocial (.60). This indicated good reliability, except for reporting of peer problems. Cronbach's  $\alpha$  for parent-reports were: TDs (.69), emotion (.61), conduct (.59), hyperactivity (.84), peer (.48) and prosocial (.95). This indicated good reliability, except for reporting of conduct and peer problems.

### **Ethical Considerations**

The research study was approved by the University of Exeter Psychology Research Ethics Committee (Appendix E). As participants were under 16 years of age, written informed consent was obtained on behalf of participants from head teachers with parental opt-out (school recruitment), and participants' parents/guardians gave written informed consent (university recruitment). Confidentiality was ensured by storing data in locked filing cabinets and electronically on encrypted software under unique identification numbers. The information sheets contained details of who to contact if participation caused distress, and participants were informed they could terminate the session if this occurred.

### **Procedure**

Written informed assent was obtained at the beginning of assessments from participants. Participants completed the demographic questionnaire, followed by administration of the assessment battery, which took 60-90 minutes. To reduce interference, fatigue and practice effects, the order that measures were administered in was counterbalanced across participants, based upon a Latin square design (Bradley, 1958; Appendix F). After assessment, participants were given letters to give to their parents/guardians to invite them to complete online questionnaires.



## **Plan for Data Analysis**

All data were analysed using SPSS version 20.

**Data cleaning.** Outliers were identified using visual (histograms and box plots) and non-visual (z-scores, Mahalanobis distance, and Cook's distance) techniques (see Appendix G for full details). Preliminary analyses were conducted to ensure variables met parametric assumptions of normal distribution, non-linearity and homoscedasticity using histograms and scatterplots.

**Consideration of covariates.** Stams et al. (2006) describe that controlling for covariates (age, SES, intelligence) in statistical analysis can reduce some legitimate construct variance in MR. Tarry and Emler (2007) highlight that as age, SES, and intelligence are all positively correlated with both MR and behaviour, failing to control for them can increase the risk of a Type I error by obscuring the true relationship between MR and behaviour. To consider both positions, it was decided to run analyses twice, once controlling for covariates, and once not controlling for covariates.

**Plan for main analyses.** The recommendations described by Baron and Kenny (1986) for investigating mediation were followed (Appendix G). Bootstrapping procedures were then performed to test the significance of the indirect effect, as these procedures are recommended for relatively small samples sizes (Hayes, 2013). For each mediation model, 5000 bootstrap samples were generated, and 95% bootstrap bias-corrected and accelerated confidence intervals (BC<sub>a</sub>) calculated and examined for significance of the indirect effect (Preacher & Hayes, 2004, 2008).

**Plan for exploratory analyses.** A hierarchical multiple regression was conducted with MR as the outcome variable to examine cognitive and affective predictors of MR. Covariates were entered at the first step of the regression equation, and cognitive and affective processes were entered in step two. Two-tailed partial Pearson correlations were performed to investigate associations between MR and behavioural sub-domains, controlling for covariates. Non-parametric (due to relatively small samples sizes) two-way independent samples Mann-Whitney U tests were used to explore gender differences.

## **Results**

No outliers were detected on any of the measures. All variables met parametric assumptions, except for parent-report measures. The regression model met parametric assumptions for multiple regression as recommended by Field (2013). There were no missing data for child measures. Throughout analyses, results corresponding to  $p < .05$  were considered statistically significant.

### **Preliminary Analyses**

Participant demographics are shown in Table 1. There was an over-representation of 13 year olds, and a slight predominance of females. Most participants were from White British middle class backgrounds.

Table 1

*Sample characteristics*

<b>Demographic</b>	<b>Value</b>	
Total <i>n</i>	72	
<b>Age</b>	<b><i>n</i></b>	<b>%</b>
Distribution: 11 year olds	4	5.5
12 year olds	11	15.3
13 year olds	39	54.2
14 year olds	18	25.0
Mean age (SD) (years)	<b>Mean</b>	<b>SD</b>
	13.50	0.76
Age range (years)	<b>Lower</b>	<b>Upper</b>
	11.02	14.85
<b>Gender</b>	<b><i>n</i></b>	<b>%</b>
Male	30	41.7
Female	42	58.3
<b>Ethnicity</b>	<b><i>n</i></b>	<b>%</b>
White British	66	91.6
Asian British	3	4.2
Black African	2	2.8
Mixed Race British	1	1.4
<b>SES</b>	<b><i>n</i></b>	<b>%</b>
Distribution: 1	1	1.4
2	1	1.4
3	6	8.3
4	18	25.0
5	13	18.1
6	8	11.1
7	9	12.5
8	8	11.1
9	8	11.1
Mean SES (SD)	<b>Mean</b>	<b>SD</b>
	5.62	2.0

*Note.* SES categories: 1 = Farm labourers/menial service workers; 2 = Unskilled workers; 3 = Machine operators, semi-skilled workers; 4 = Smaller business owners, skilled manual workers, craftsmen, tenant farmers; 5 = Clerical/sales workers, small farm/business owners; 6 = Technicians, semi-professionals, small business owners; 7 = Smaller business owners, farm owners, managers, minor professionals; 8 = Administrators, lesser professionals, proprietors medium-sized businesses; 9 = Higher executives, proprietors large businesses, major professionals (Hollingshead, 2011).

Descriptive statistics for the main variables are shown in Table 2. Global MR stage ranged from Transition 2(1) to Stage 3, and on average was Transition Stage 3(2) (i.e., transition between immature and mature MR). This is consistent with the typical MR stage of the general population in early

adolescence (Gibbs, 2014). All participants reported some behavioural difficulties, with some reporting the maximum hyperactivity and emotional problems. Participants reported more strengths than difficulties.

Table 2

*Descriptive statistics for main variables*

Measure	Mean(SD)	Range
SRM-SF: SRMS	257.63 (27.65)	177 – 323
Contract	256.96 (39.08)	150 – 350
Truth	253.10 (59.94)	100 – 400
Affiliation	272.92 (37.24)	150 – 325
Life	257.29 (43.69)	150 – 400
Property	232.61 (73.18)	100 – 350
Law	260.56 (73.64)	100 – 400
Legal Justice	252.38 (70.96)	100 – 400
FSIQ (standardised score)	100.56 (13.98)	71 – 133
AWMA (standardised composite score)	85.53 (9.29)	65 – 108
CNT efficiency	.38 (.20)	.08 – .83
EQ total (self-report)	42.57 (10.43)	21 – 67
EQ-C total (parent-report)	41.65 (7.54)	29 – 52
Self-report SDQ: TDs	12.17 (5.67)	3 – 26
Hyperactivity	4.39 (2.38)	0 – 10
Conduct	1.99 (1.71)	0 – 6
Emotional	3.72 (2.41)	0 – 10
Peer	2.07 (1.44)	0 – 7
Prosocial	7.69 (1.63)	3 – 10
Parent-report SDQ: TDs	7.89 (4.32)	1 – 17
Hyperactivity	3.42 (2.78)	0 – 9
Conduct	1.47 (1.58)	0 – 5
Emotional	1.79 (1.84)	0 – 6
Peer	1.74 (1.75)	0 – 6
Prosocial	8.89 (1.37)	5 – 10

As a low response rate for parent reports of behaviour (26%) and empathy (23%) were obtained, parent reports were not included in the primary statistical analysis. Preliminary analysis (Kendall's tau) revealed significant correlations between parent and child reports of SDQ TDs ( $\tau = .57, p = .002$ ),

hyperactivity ( $\tau = .57, p = .002$ ), conduct ( $\tau = .46, p = .022$ ), emotional ( $\tau = .38, p = .045$ ) and peer problems ( $\tau = .448, p = .020$ ). There were no significant relationships between parent and child reports of empathy ( $\tau = .17, p = .358$ ) or prosocial behaviour ( $\tau = .02, p = .907$ ). These findings suggest some corroboration between self- and proxy-reports on the SDQ only.

Relationships between all key variables are shown in Table 3.

Correlations revealed significant positive associations between: intelligence and SES; intelligence and MR; intelligence and WM; intelligence and CFI; SES and WM; SES and CFI; MR and WM; WM and CFI. Significant negative associations were found between age and intelligence; age and SES; age and empathy; SES and behaviour.

Table 3

*Bivariate zero-order Pearson correlations among study variables*

	2	3	4	5	6	7	8
1. Age	-.38**	-.25*	-.09	.09	-.06	-.03	-.24*
2. FSIQ		.46**	.42**	-.14	.49**	.40**	.07
3. SES			.15	-.28*	.24*	.34**	.04
4. SRMS				.14	.42**	-.04	.17
5. SDQ TDs					.02	-.07	-.02
6. AWMA						.38**	-.09
7. CNT-E							-.05
8. EQ							

Note: \* $p < .05$ ; \*\* $p < .01$

## Main Analyses

Results from correlation analyses revealed a significant association between the EFs (WM and CFI) with a medium effect size (Table 3). To account for this, the mediation analysis was repeated combining participants' scores for WM and CFI into an "overall EF" score. As this analysis did not affect findings, it is presented in Appendix H. As controlling for covariates (age, intelligence, SES) also did not affect findings, results presented below reflect analyses

controlling for covariates, and results not controlling for covariates are presented in Appendix H.

**Hypothesis one.** The hypothesis that MR mediates the relationship between CFI and self-reported behaviour, controlling for covariates, was not supported. In step 1 of the mediation model, the regression of the predictor CFI on the outcome behaviour (path c) was not significant,  $b = 1.13$ ,  $t(70) = 0.30$ ,  $p = .764$ . Step 2 showed that the predictor CFI was significantly associated with the proposed mediator MR (path a),  $b = -36.17$ ,  $t(70) = -2.16$ ,  $p = .034$ . In step 3, the proposed mediator MR was not significantly associated with the outcome behaviour, controlling for the predictor (path b),  $b = 0.05$ ,  $t(70) = 1.86$ ,  $p = .067$ . Step 4 revealed that the predictor CFI was not significantly associated with the outcome behaviour, when controlling for the proposed mediator (path c'),  $b = 2.95$ ,  $t(70) = 0.77$ ,  $p = .443$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between CFI and behaviour,  $b = -1.81$ ; 95% BC<sub>a</sub> [-4.95, 0.01].

**Hypothesis two.** The hypothesis that MR mediates the relationship between WM and self-reported behaviour, controlling for covariates, was not supported. In step 1, the regression of the predictor WM on the outcome behaviour was not significant (path c),  $b = 0.07$ ,  $t(70) = 0.83$ ,  $p = .407$ . Step 2 showed that the predictor WM was significantly associated with the proposed mediator MR (path a),  $b = 0.84$ ,  $t(70) = 2.28$ ,  $p = .026$ . In step 3, the proposed mediator was not significantly associated with the outcome behaviour, controlling for the predictor (path b),  $b = 0.04$ ,  $t(70) = 1.54$ ,  $p = .127$ . Step 4 revealed that the predictor WM was not significantly associated with the outcome behaviour, when controlling for the proposed mediator (path c'),  $b =$

0.03,  $t(70) = 0.40$ ,  $p = .692$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between WM and behaviour,  $b = 0.04$ ; 95% BC<sub>a</sub> [0.00, 0.12].

**Hypothesis three.** The hypothesis that MR mediates the relationship between empathy and self-reported behaviour, controlling for covariates, was not supported. The regressions in all four steps were non-significant: path a,  $b = 0.44$ ,  $t(70) = 1.48$ ,  $p = .143$ ; path b,  $b = 0.04$ ,  $t(70) = 1.75$ ,  $p = .086$ ; path c,  $b = -0.00$ ,  $t(70) = -0.02$ ,  $p = .984$ ; path c',  $b = -0.02$ ,  $t(70) = -0.33$ ,  $p = .742$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between empathy and behaviour,  $b = 0.02$ ; 95% BC<sub>a</sub> [-0.00, 0.09].

### Exploratory Analyses

Results of the exploratory analyses should be interpreted with caution due to: (a) no a priori hypotheses; (b) uncorrected multiple comparisons.

#### Relative contribution of cognitive and affective processing to MR.

Results of the hierarchical regression indicated that in step 1, age, intelligence, and SES contributed significantly to the regression model,  $F(3,68) = 5.04$ ,  $p = .003$ , and accounted for 18% of the variance in MR ( $R^2_{adjusted} = .15$ ). In step 2, introducing CFI, WM and empathy explained an additional 17.4% of the variance in MR, and this change in  $R^2$  was significant,  $\Delta F(3,65) = 5.84$ ,  $p = .001$ . In total, model two explained a total of 35.6% of the variance in MR ( $R^2_{adjusted} = .30$ ). Table 4 shows the individual predictors of variance in MR. In model one, intelligence was a significant unique predictor of the variance in MR, however, SES and age were not. In model two, WM and CFI each significantly predicted unique variance in MR above and beyond the other predictors. This

was a positive association for WM, and a negative association for CFI.

Empathy, however, did not significantly predict MR.

Table 4

*Hierarchical regression analysis*

Model	<i>B</i>	SE ( <i>B</i> )	Confidence intervals for <i>B</i>		Beta	<i>t</i>
			Lower	Upper		
1. Constant	127.86	70.81	-13.44	269.16		1.81
Age	2.97	4.33	-5.68	11.61	.08	0.69
SES	0.68	1.72	-4.11	2.75	-.05	-0.40
FSIQ	0.93	0.26	0.42	1.44	.47**	3.62
2. Constant	18.75	71.15	-123.36	160.85		0.26
Age	4.52	4.10	-3.68	12.72	.12	1.10
SES	0.17	1.60	-3.02	3.36	.01	0.11
FSIQ	0.78	0.27	0.24	1.31	.39**	2.88
EQ	0.50	0.27	-0.05	1.04	.19	1.81
AWMA	1.11	0.35	0.41	1.82	.37**	3.15
CNT-E	-45.10	15.96	-76.96	-13.23	-.32*	-2.83

Note: \* $p < .05$ ; \*\* $p < .01$ .

**Associations between sub-domains of MR and self-reported**

**behaviour.** Correlations revealed that total MR was not significantly associated with any sub-domain of self-reported strength or difficulty ( $r$  ranged from  $-.07$  to  $.21$ ,  $ps > .05$ ), controlling for covariates. TDs were significantly associated with a medium effect size for the truth ( $r = .27$ ,  $p = .047$ ) and large effect size for the law ( $r = .42$ ,  $p = .001$ ) sub-domains of MR, controlling for covariates. TDs were not significantly associated with the contract, affiliation, life, property and legal justice subdomains of MR ( $r$  ranged from  $.04$  to  $.27$ ,  $ps > .05$ ), controlling for covariates. Not controlling for covariates removed significance between the truth sub-domain and TDs to a non-significant small effect ( $r = .15$ ,  $p = .227$ ), however, did not affect the significance of the other associations (Appendix H).

**Association with gender.** Table 5 shows that no significant gender differences were demonstrated on MR, empathy, or CFI. Boys had significantly



higher WM than girls. Girls reported significantly higher TDs, emotional and peer difficulties than boys.

Table 5

*Results for the association of variables with gender*

Measure	Male Mean (SD)	Female Mean (SD)	Mann- Whitney U	z	p (two-tailed)	r
SRMS	255.53 (33.18)	259.12 (23.23)	604.50	-0.29	.771	-.03
FSIQ (standardised score)	102.73 (14.37)	99.00 (13.66)	547.50	-0.94	.346	-.11
AWMA (standardised composite score)	88.40 (8.80)	83.48 (9.19)	456.50	-1.98	.047	-.23
CNT efficiency	.40 (.19)	.37 (.21)	587.00	-0.49	.623	-.06
EQ total	40.13 (9.41)	44.31 (10.87)	476.00	-1.76	.078	-.21
SDQ TDs	10.33 (5.16)	13.48 (5.71)	427.00	-2.32	.020	-.27
SDQ hyperactivity	4.00 (2.20)	4.67 (2.50)	529.00	-1.16	.245	-.14
SDQ conduct	2.33 (1.83)	1.74 (1.60)	512.00	-1.38	.168	-.16
SDQ emotional	2.33 (1.63)	4.71 (2.40)	270.00	-4.15	<.001	-.49
SDQ peer	1.67 (1.21)	2.36 (1.53)	454.00	-2.07	.039	-.24
SDQ prosocial	7.5 (1.80)	7.83 (1.51)	570.00	-0.07	.484	-.01

## Discussion

The aims of this study were to examine whether WM is associated with MR, and whether MR mediates the relationship between EFs and self-reported

behaviour, and between empathy and self-reported behaviour in typically developing adolescents. The study reported a positive association between WM and MR, which is a novel finding, and confirms predictions of SST. The hypothesised mediation models, however, were not supported, as there was no unique association between global MR and behaviour, or between EFs/empathy and behaviour, with or without controlling for the effect of intelligence, SES and age. It may, however, be premature to reject the hypothesis altogether, for reasons that will now be discussed.

An underlying assumption of MR theories is that MR relates to behaviour, and this relationship has been well-replicated in offending/clinical populations (Stams et al., 2006; van Vugt et al., 2011). The lack of association between global MR and behaviour demonstrated in the current study, however, highlights that there is limited evidence for this association in typically developing adolescents. Leenders and Brugman (2005) and Tarry and Emler (2007) also reported no relationship between MR and self-reported delinquent behaviour in adolescents. Results from these studies were considered biased due to significant numbers of SRM-SF interviews not meeting the criteria of seven items scored. The findings from the current study, however, are consistent with these findings, despite the present study not having the same methodological difficulties.

Given that the current study relied on a self-report measure of behaviour, one possible interpretation for the lack of significant association between MR and behaviour, is that the participants in the current study under-reported their behavioural difficulties. Although some studies have found that delinquent youth under-report aggressive behaviours on self-report measures (Breuk,

Clauser, Stams, Doreleijers, & Slot, 2007), the majority of studies demonstrating positive associations between MR and behaviour do not support this interpretation, as these studies also use self-reported behavioural data (Stams et al., 2006; van Vugt et al., 2011).

The required sample size for the current study was estimated based upon the findings from a previous study demonstrating a positive association between self-reported behaviour and MR, with a medium effect size, in typically developing early adolescents (Bear, 1989). Bear reported, however, that his sample had an over-representation of youth with conduct and aggressive behaviours, which might have contributed to the size of the association found between MR and behaviour in this study. It is, therefore, possible that the association between MR and self-reported behaviour in typically developing youth is small, and not a medium to large effect as found in delinquent samples or those with high levels of aggression and conduct behavioural problems (e.g., Bear, 1989). Future studies could examine the relationship between MR and behaviour in a larger representative sample of typically developing youth. Following the recommendations of Cohen (1992), to yield a power of .80 at an alpha significance of .05 for a large effect size, 393 participants would be required.

Empathy was not associated with behaviour or MR, with or without controlling for covariates. These findings are partially consistent with a previous meta-analysis, which confirmed a significant negative relationship between empathy and offending that was not present when SES and intelligence were controlled for (Jolliffe & Farrington, 2004). Some studies have reported a positive association between MR and empathy in adolescents (Barriga et al.,

2009), whereas others have not (Humphries, Parker, & Jagers, 2000). Theories disagree as to when empathy becomes associated with MR developmentally. It has been hypothesised that during moral development, MR is dependent on deliberate, effortful cognitive processes. In comparison, when mature MR is reached, MR may be increasingly dependent upon affective processes, such as empathy and emotion-based decision making (Decety et al., 2012). During adolescence, individuals progress from immature to mature MR, therefore, it may be that in early adolescence (as captured by the current study), empathy is not associated with MR.

Although exploratory analyses should be interpreted with caution (due to no a priori prediction), they revealed an association between the truth and law sub-domains of MR and self-reported behaviour. These tentative findings are partially consistent with research in adult offenders with IDs, who have lower MR in the law and legal justice sub-domains when compared to adults with IDs who do not offend (Langdon, Murphy, et al., 2010; Langdon et al., 2011; McDermott & Langdon, 2014). It is possible, therefore, that only certain sub-domains of MR, such as those relating to truth and law are associated with self-reported behaviour, which warrants further investigation.

Exploratory analyses also revealed that WM, intelligence and CFI were all unique predictors of the variance in MR. These findings are consistent with a recent study demonstrating associations between EFs and MR in typically developing adolescents (Vera-Estay et al., 2015). CFI was, however, negatively associated with MR, with lower CFI skills associated with higher MR. This is contradictory to previous studies demonstrating a positive association between CFI and MR (Cottone et al., 2007; Vera-Estay et al., 2015). In addition, the

majority of variance in MR was unaccounted for, suggesting either that measures selected did not capture enough variance in the cognitive/affective processes tested (discussed in the Strengths and Limitations sub-section), or that additional variance was related to unmeasured variables (discussed in Future Research sub-section).

In contrast to previous findings (e.g., Stams et al., 2006), exploratory analyses revealed that age and SES were not unique predictors of variance in MR. As the study sample mostly consisted of 13 year old White middle class individuals, it is possible that there was not enough heterogeneity in age or SES for them to uniquely predict MR. In terms of SES, this agrees with previous findings in a similarly homogenous adolescent population (Vera-Estay et al., 2015).

Exploratory analyses revealed that there were no significant gender differences in MR, which is consistent with the majority of research (Stams et al., 2006). Girls reported more overall difficulties than boys, however, this was accounted for by increased self-reported emotional and peer difficulties in girls, which is consistent with previous research in UK samples (Fink et al., 2015). Future research may aim to investigate gender differences further. If there are no gender differences in MR, but there are gender differences in behaviour (as suggested by this study and previous research), the mechanisms by which MR affects behaviour may be different in boys compared to girls, which warrants further investigation.

### **Theoretical Implications**

As the absence of an association between MR and self-reported behaviour may reflect methodological considerations (already discussed), the

following implications are tentative. If future research confirms the findings of the present study that MR is not associated with self-reported behaviour in typical development, then this needs to be accounted for, and mechanisms explored, in MR theories. In addition, if research continues to suggest that empathy is not associated with MR during early adolescence, MR theories may need to be revised to understand the contribution of cognitive and affective processes at different developmental stages. This could be supported by longitudinal research in typical development, which may benefit from integrating MR theories with SIT to explain how MR influences social information processing and, subsequently, behaviour.

As results supported the association between EFs and MR, future researchers may wish to consider EFs when investigating MR in adolescents. Numerous contextual factors are known to temporarily impair EFs, such as if individuals are tired, sad, lonely, or physical unfit (see Diamond, 2013 for a review). Research investigating the effect of these contextual variables may help to increase the ecological validity of MR theories. For example, stress can impair EF (Liston, McEwen, & Casey, 2009), and preliminary evidence suggests that acute stress affects moral-decision making (Youssef et al., 2012). It is possible, therefore, that stress may impair MR due to its effect on EFs. Research investigating the influence of such variables, and additional situational variables known to influence social competence, such as face processing and peer influences (Blakemore & Mills, 2014) may, therefore, be used to update and increase the ecological validity of MR theories. This may provide insight as to whether impaired or delayed MR can be buffered by positive environmental contexts, which may be used to inform offender rehabilitation programmes.

## **Clinical Implications**

Although the finding of an association between EFs and MR in the current study are preliminary and need to be confirmed by future studies, they suggest that interventions such as EQUIP may benefit from including EF skills training. Longitudinal research and meta-analyses have concluded that intact EF skills in youth are associated with positive outcomes in adulthood, such as social adjustment, improved physical health and finance, and reduced offending (Moffitt et al., 2011). Numerous programmes have been developed that improve EFs, including computerised training, aerobic exercise, mindfulness, and martial arts (Diamond, 2014a). Enhancing EQUIP with interventions aimed at advancing EFs may, therefore, result in personal gains (e.g., improved MR and social adjustment), which may have a knock-on effect of improving familial and societal outcomes.

## **Strengths and Limitations of the Study**

Strengths of the study included that it was grounded in theory and integrated a well-validated MR theory with SIT to test predictions of *how* MR affects self-reported behaviour. This is an important theoretical question with clinical applications, and has received little attention in previous research. The use of typically developing adolescents addressed a gap in the literature, as little is known about typical moral development. The methodology was strengthened by the use of a production measure of MR, which are less influenced by social desirability than recognition measures as the individual must explain their reasoning (Langdon, Clare, & Murphy, 2010). High inter-rater reliability was achieved with an expert rater, increasing reliability. Administration of the SRM-SF as an interview controlled for confounding variables (i.e.,

reading/writing ability), and the strict inclusion/exclusion criteria reduced the effect of other confounders. The absence of missing child data increased validity. The number of participants recruited exceeded the number indicated by the power calculation, and most variables met the assumptions for parametric tests.

A limitation of the study was its cross-sectional design, which did not permit investigation of causality. The sample was relatively homogenous in demographics, which reduced generalisability. The reliance on self-report measures of empathy and behaviour were a further limitation, and only a small number (< 25%) of parent reports were obtained. Brewer and Hunter (2006) suggest that multi-method approaches are preferable to self-report when measuring behavioural difficulties, and Lovett and Sheffield (2007) highlight the limitations of self-report measures of empathy in adolescents as their accuracy is dependent upon honesty and self-awareness. Furthermore, the choice of the EQ was a potential limitation, as it has not been validated for use in adolescents. Assessment of its internal consistency, however, suggested that it was a reliable measure in the sample. Although the EQ captures both cognitive and affective components of empathy (Baron-Cohen & Wheelwright, 2004), neuroimaging studies have suggested that each component of empathy has a different relationship with MR (Decety & Cowell, 2014). Such research would imply that investigating components of empathy separately utilising diverse measures may be a more useful technique to elucidate the complex relationship between MR and empathy (Decety & Cowell, 2014).

The use of the WASI-II was a potential limitation, due to its reliance on US norms. Although the test's owners report that UK norms should be



equivalent to US norms (see Pearson statement, Appendix I), research has found that different FSIQ scores are derived when using US versus Canadian norms of the WAIS-IV (Harrison, Armstrong, Harrison, Lange, & Iverson, 2014). This may suggest that caution should be used when interpreting US norms in UK samples.

The use of the CNT had both strengths and limitations. The CNT overcomes the limitations of many other EF measures as it is not affected by reading ability, a non-executive skill (Kirk, Mazzocco, & Kover, 2005). The CNT has not, however, been compared with other well-established, standardised measures of EF. It is, therefore, difficult to ascertain whether the CNT measures similar skills. Furthermore, using only two measures of EF, although optimised task administration time (given the length of the assessment battery), is a limitation given that EF is a multifaceted construct (Diamond, 2013).

SES was an approximate estimate in this study, as the measure used only considered child-reported parental occupation. As SES is a multifaceted concept, ideally additional variables (e.g., parental income, parental educational level and postcode) would have been used to calculate SES (Brito & Noble, 2014).

The results from the exploratory analyses should be interpreted with caution as they involved multiple statistical testing, which inflates the probability of type I errors. Furthermore, as Miles and Shevlin (2001) suggest that 100 participants are required to obtain adequate power for a medium effect size with six predictors in a regression, the regression analysis may have lacked statistical power.

## Future Research

The findings from this study point to a number of recommendations for future research. To further understand moral development, longitudinal research is required that measures MR and processes known to be associated with MR and behavioural difficulties over time in large samples of typically developing children. This study and previous research suggest that future studies may also benefit from investigating inter-relationships between both global MR and the sub-domains of MR to further elucidate the mechanisms leading to behavioural disturbance. McDermott and Langdon (2014) highlight that this research is complex, because many of the social factors relating to offending behaviours are also related to moral development. For example, MR, behaviour, general development, and opportunities for social perspective taking are influenced by systemic factors including significant life events, education opportunities, and peer and parental influence (McDermott & Langdon, 2014). Research has also suggested that relationships between behaviour, cognition, MR and social development may be bi-directional. For example, individuals can regress to less developmentally mature stages of MR if contextual factors (e.g., peer pressure and cognitive dissonance) allow (Leenders & Brugman, 2005). Research should, therefore, take an integrative approach to investigate children's moral development, and examine causal relationships, and mediating and moderating influences as to how emotions and cognition dynamically interact over development and become increasingly coordinated to shape MR and behaviour.

As EFs were associated with MR in this study, research investigating clinical populations with EF impairments and associated behaviour disturbances

may be helpful in deciphering mechanisms involved in this association. Although some preliminary evidence has been found in a cross-sectional TBI population (Beauchamp et al., 2013), longitudinal research is required to advance understanding of causal mechanisms. Additionally, the research could be extended to include other clinical populations with EF impairments and behavioural disturbance, such as individuals with attention deficit hyperactivity disorder or autism.

In addition to contextual variables, future studies should consider the role of emotion in MR (e.g., theory of mind and emotion recognition). Currently the majority of evidence for factors underpinning MR has focused upon cognitive processing, despite SST and neuroimaging studies advocating a joint role for cognitive and affective processing (Decety & Cowell, 2014). MR measures using visual-based tasks (e.g., pictures/videos) may offer improved insight into affective processing and everyday MR skills that guide behaviour, as such measures involve socio-emotional processing in the interpretation of stimuli (Dooley et al., 2010). Additionally virtual reality studies are enabling the study of individuals' actions in response to complex moral dilemmas without the ethical risk of committing harmful acts in reality (Patil, Cogoni, Zangrando, Chittaro, & Silani, 2014). Such research, in addition to studies utilising eye tracking and mood induction techniques might assist the investigation of the real life processing element of MR (Arsenio, 2010).

### **Conclusion**

This study found associations between EFs and MR in typically developing adolescents. Despite predictions of MR theories, MR was not associated with self-reported behaviour, and therefore, MR did not mediate the

relationship between EFs/empathy and self-reported behaviour. It may be beneficial to repeat this study in a larger sample to account for the possibility that the true association between MR and behaviour in typical development is a weak effect, as opposed to a large effect previously demonstrated in offending populations. Additionally, it would be interesting to compare relationships in typical development with individuals who have clinically associated EF impairments and behavioural disturbance, for example, individuals with TBI, autism, or attention deficit hyperactivity disorder. Studies may also aim to examine the influence of different sub-domains of MR on behaviour and gender differences. Future research should aim to investigate mediating and moderating influences of cognitive and affective processing in moral development over time (longitudinal studies), and how these relationships influence behaviour. This may enhance the theoretical understanding of MR, and thus improve assessment approaches and the efficiency of existing intervention and prevention programmes that foster moral resilience and aim to reduce offending.

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## Appendices

### Appendix A: Glossary of terms

**Cognitive flexibility/inhibition:** The ability to simultaneously consider multiple concepts and switch between tasks (Martin & Rubin, 1995), and to suppress distracting stimuli that is irrelevant for task completion (Serrien & Sovijärvi-Spapé, 2013).

**Empathy:** A continuum of skills which comprise both cognitive and affective processes. Cognitive empathy describes the ability to intellectually understand others' emotional states alongside situational cues, whereas affective empathy is the ability to have an emotional response to the emotional state of another that is congruent with their situation as opposed to one's own situation (i.e., "emotional contagion"; Baron-Cohen & Wheelwright, 2004; Cohen & Strayer, 1996; Watt, 2007). In addition, empathy involves motivational components (i.e., empathic concern), which relates to the urge of caring for the welfare of another (Decety & Cowell, 2014).

**Executive functions:** A range of higher order integrating and converging cognitive processes that are activated in a situation-specific manner to allow individuals to organise, evaluate and modify their thoughts and behaviours to achieve future goals in the light of complex and novel situations (Hughes, 2011). Examples are cognitive flexibility/inhibition, working memory, and abstract reasoning (also defined in this table).

**Moral domain:** This is one of the three domains of social knowledge, and represents knowledge concerning issues of justice, welfare, human rights and fairness (Turiel, 1983).

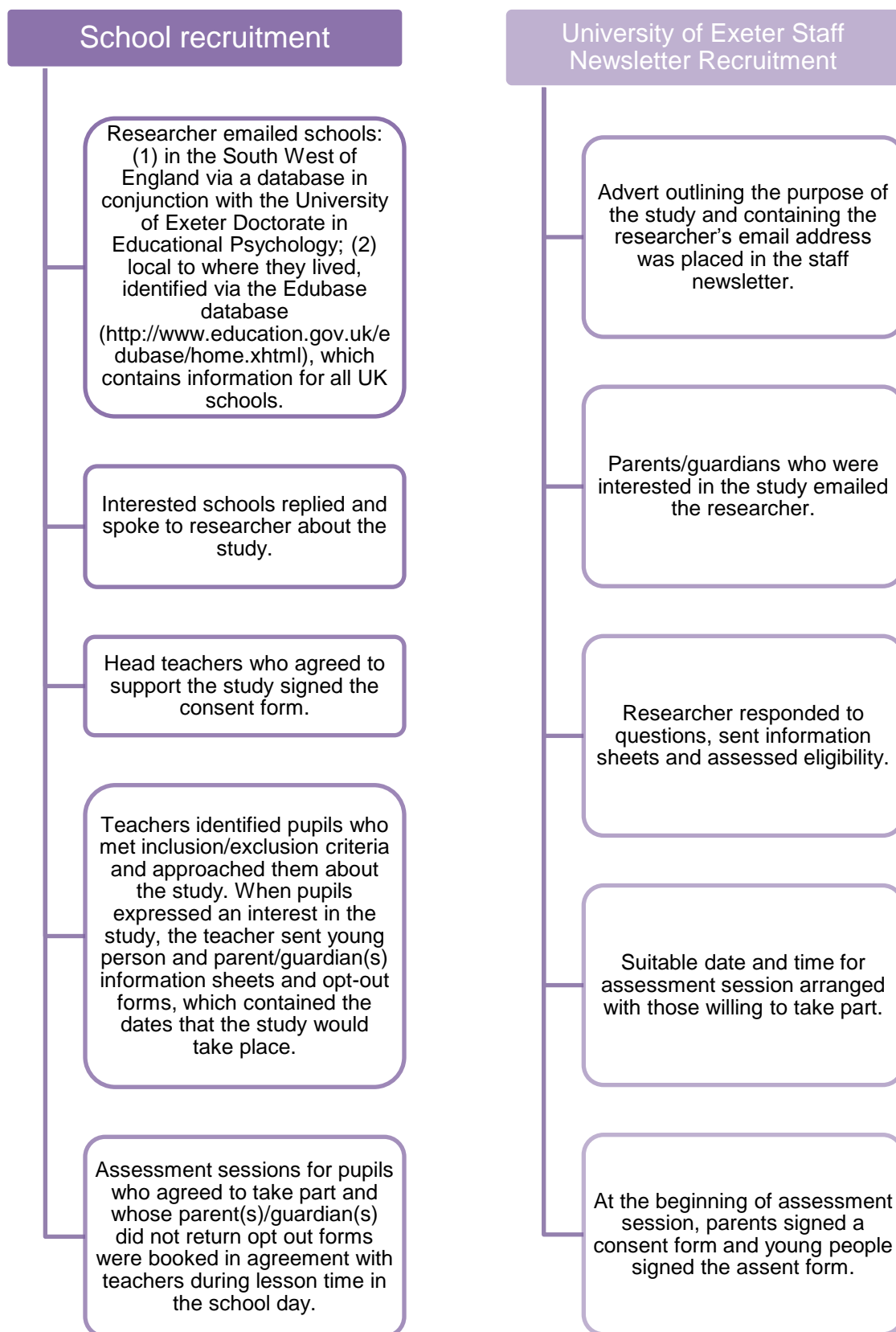
**Moral judgment:** This reflects a decision made within the moral domain, for example, whether a situation is morally right or wrong (Moll et al., 2005).

**Moral reasoning:** This reflects the cognitive and affective processing that occurs when an individual is making a moral judgment (Moll et al., 2005).

**Theory of mind (ToM):** An umbrella term of skills that comprises of cognitive and affective processes which allow individuals to infer the beliefs and motivations of others (“cognitive ToM”) and to infer what another individual is feeling (“affective ToM”; Shamay-Tsoory, Harari, Aharon-Peretz, & Levkovitz, 2010).

**Working memory:** The ability to temporarily store and manipulate information (Alloway & Alloway, 2010).

## Appendix B: Recruitment Flow Charts





## Appendix C: Recruitment documentation

(1) Child assent form (both recruitment methods)



Miss Kate Littler & Dr Anna Adlam  
 College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

### How do judgments relate to action in young people?

#### Assent Form for Young People

Please take the time to read this assent form carefully. If you have any questions, please do not hesitate to ask the researcher.

I (name).....,

\* have read and understood the information sheet outlining the study (Please initial)

\* understand that my participation in the study is completely voluntary, will not affect my education, and, that if I do participate then I am free to withdraw at any time without giving reason (Please initial)

\* agree for my data to be stored anonymously for a minimum of five years (Please Initial)

\* agree to take part in this study (Please Initial)

Signature of young person: .....

Date: .....

## (2) Parental consent form (University of Exeter staff newsletter recruitment)



Miss Kate Littler &amp; Dr Anna Adlam

College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

**How do judgments relate to action in young people?****Consent Form for Parents**

Please take the time to read this consent form carefully. If you have any questions, please do not hesitate to ask the researcher.

I (name).....,

parent/guardian of (child's name) .....

\* have read and understood the information sheet outlining the study (Please initial)

\* understand that my child's participation in the study is completely voluntary, and if they do participate they are free to withdraw at any time and without giving reason (Please initial)

\* agree for my child's data to be stored anonymously for a minimum of five years  
 (Please Initial)

\* agree for my child to take part in this study (Please Initial)

Parent's signature:.....

Date: .....

## (3) Head teacher consent form (school recruitment)



Miss Kate Littler & Dr Anna Adlam  
 College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

**Consent form for Head Teachers****How do judgments relate to action in young people?**

I (name)....., head teacher of (school) .....

\* have read the letter dated..... sent to me by Kate Littler about the research study entitled 'How do judgments relate to action in young people?'.

(Please Initial)

\* give consent/do not give consent (please delete as applicable) for the children of this school to participate in the research proposed by Kate Littler, Doctoral Student at the University of Exeter.

(Please Initial)

\* understand that the parents/guardians of potential participants will be contacted via the school and sent an information sheet about the study. Young people will also receive a copy of the information sheet. Parents/guardians will be asked to return an opt-out form if they wish for their child to be excluded from the research. Children will give their assent to participate.

(Please initial)

\* as the research does not pose an ethical dilemma, I agree to consent for children under the age of 16 years whose parents/guardians have not withdrawn them from the study.

(Please Initial)

\* understand that the data collected will solely be used for this research project, and that the name of the school, or the name of the children will not be identified.

(Please Initial)

Signature:.....

Date:.....

## (4) Young person information sheet (school recruitment)



College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom



**How do judgments relate to action in  
 young people?**



**Information Sheet for Young Person**

**(Please keep this copy)**

My name is Kate Littler. I am training to be a clinical psychologist at the University of Exeter. As part of my training, I need to carry out a study, and would like to ask you to take part. Before you decide, I would like you to understand why the study is taking place, and what you would have to do. Please talk to other people about it if you want, and feel free to ask me any questions when you meet me.

- **What is the study about?**

We know that how people think can change what they do. I am interested in how young people think about day-to-day situations, and how this affects what they do in these situations. This study aims to understand the link between these things further.

- **Why have you been chosen?**

You are being asked to take part because your school is supporting my study, and you are in the age range I need (11-14 years).

- **Do you have to take part?**

No. It is entirely up to you whether you would like to take part. This sheet is to give you some more information about the study. If you do not want to take part, then just let me, your parents/guardians or your teacher know. You do not have to give me a reason if you do not want to take part, and it will not affect your education.

- **What does the study involve?**

If you want to take part, then you will come to a session with me during school time. You may have to miss a lesson, and this will be agreed with your teacher.

At this session, you can ask me some questions about the study if you want, and I will ask you to sign a sheet to say you are happy to take part. Then I will ask you to complete some puzzles and answer some questions. This will take about an hour, but if you want a break, then just let me know. After this session, I will put your answers onto a computer. Each person who takes part is given a number, and answers are stored by this number instead of your name. This means that other people will not know which answers are yours.

- **Will my taking part be kept confidential?**

Yes. All the information I receive from you is confidential, which means that I will not tell anyone that you have taken part in the study, or what your answers were. Your answers will be given a code number and will be entered using this onto the computer.

- **What are the possible benefits of taking part?**

Although taking part will not directly benefit you, by taking part you are helping us to understand how and why thinking affects what people do. This will hopefully help us to understand why some other young people have problems with their thinking or behaviour. Often, young people enjoy the assessment procedure and thinking about some of the questions that they have been asked.

- **What are the possible disadvantages of taking part?**

Some young people may find the assessment procedure long, however you can take a break or complete some tests in another session if you want. Tests will be undertaken during school time, so you may have to miss a lesson. This will be agreed with your teacher. It is unlikely that you would find the procedure distressing. However, if you did, then we would stop the session and have a chat about what was upsetting. If you did not want to carry on with the study then that would be fine, and I would delete your data. If you felt you needed any support, then I could talk to your teacher about what I think might help.

- **What will happen if I don't want to carry on in the study?**

You are free to stop taking part at any time. You just have to let me know, but you do not have to give a reason. You can decide whether you are happy for data already collected to be processed or if you would like it to be destroyed.

- **What if there is a problem?**

There should not be any problems taking part in this study, however, if there are, you or your parent/guardian can contact me or my supervisor using the details at the end of this sheet.

- **What will happen to the study results?**

I will write up the results of this study for my training at the University of Exeter. The research might also be published in a journal.

- **Who is organising and funding the research?**

This is being conducted as a thesis, as part of a Doctorate of Clinical Psychology course at the University of Exeter. This study is being supervised by Dr Anna Adlam, Senior Lecturer and Co-Director for the Centre for Clinical Neuropsychology Research.

- **Who has reviewed and approved this study?**

This research has been considered by an independent group of people, called a Research Ethics Committee. This study was reviewed by the University of Exeter Ethics board, and was approved.

Thank you for taking the time to read this information sheet.

This is your copy to keep.

I would be extremely grateful for your assistance.

If you would like any further information about this study, please do not hesitate to contact the researcher, Kate Littler:

Email: xxxxxxxxxxxxxx

If you would like to talk to the researcher's supervisor, Dr Anna Adlam of the University of Exeter, then please use the following details;

Email: xxxxxxxxxxxxxx Telephone: xxxxxxxxxxxxxx

If you wish to make a complaint about the study, then please contact Dr Adlam using the above details.

(5) Young person information sheet (University of Exeter staff newsletter  
recruitment)



College of Life & Environmental Sciences  
Washington Singer Laboratories  
Streatham Campus  
United Kingdom



How do judgments relate to action in  
young people?



**Information Sheet for Young Person**

**(Please keep this copy)**

My name is Kate Littler. I am training to be a clinical psychologist at the University of Exeter. As part of my training, I need to carry out a study, and would like to ask you to take part. Before you decide, I would like you to understand why the study is taking place, and what you would have to do. Please talk to other people about it if you want, and feel free to ask me any questions when you meet me.

- **What is the study about?**

We know that how people think can change what they do. I am interested in how young people think about day-to-day situations, and how this affects what they do in these situations. This study aims to understand the link between these things further.

- **Why have you been chosen?**

You are being asked to take part because you are in the age range I need (11-14 years) for the study.

- **Do you have to take part?**

No. It is entirely up to you whether you would like to take part. This sheet is to give you some more information about the study. If you do not want to take part, then just let me or your parents/guardians know. You do not have to give me a reason if you do not want to take part, and it will not affect your education.

- **What does the study involve?**

If you want to take part, then I will arrange a session to see you with your parent/guardian. At this session, you can ask me some questions about the study if you want, and I will ask you to sign a sheet to say you are happy to take part. Then I will ask you to complete some puzzles and answer some questions. This will take about an hour, but if you want a break, then just let me know. After this session, I will put your answers onto a computer. Each person who takes part is given a number, and answers are stored by this number instead of your name. This means that other people will not know which answers are yours.

- **Will my taking part be kept confidential?**

Yes. All the information I receive from you is confidential, which means that I will not tell anyone that you have taken part in the study, or what your answers were. Your answers will be given a code number and will be entered using this onto the computer.

- **What are the possible benefits of taking part?**

Although taking part will not directly benefit you, by taking part you are helping us to understand how and why thinking affects what people do. This will hopefully help us to understand why some other young people have problems with their thinking or behaviour. Often, young people enjoy the assessment procedure and thinking about some of the questions that they have been asked.

- **What are the possible disadvantages of taking part?**

Some young people may find the assessment procedure long, however you can take a break or complete some tests in another session if you want. It is unlikely that you would find the procedure distressing. However, if you did, then we would stop the session and have a chat about what was upsetting. If you did not want to carry on with the study then that would be fine, and I would delete your data. If you felt you needed any support, then I could talk to your teacher about what I think might help.

- **What will happen if I don't want to carry on in the study?**

You are free to stop taking part at any time. You just have to let me know, but you do not have to give a reason. You can decide whether you are happy for data already collected to be processed or if you would like it to be destroyed.

- **What if there is a problem?**

There should not be any problems taking part in this study, however, if there are, you or your parent/guardian can contact me or my supervisor using the details at the end of this sheet.

- **What will happen to the study results?**

I will write up the results of this study for my training at the University of Exeter. The research might also be published in a journal.

- **Who is organising and funding the research?**

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- **Who has reviewed and approved this study?**

This research has been considered by an independent group of people, called a Research Ethics Committee. This study was reviewed by the University of Exeter Ethics board, and was approved.



Thank you for taking the time to read this information sheet.

This is your copy to keep.

I would be extremely grateful for your assistance.

If you would like any further information about this study, please do not hesitate to contact the researcher, Kate Littler:

Email: xxxxxxxxxxxxxx

If you would like to talk to the researcher's supervisor, Dr Anna Adlam of the University of Exeter, then please use the following details;

Email: xxxxxxxxxxxxxx Telephone: xxxxxxxxxxxxxx

If you wish to make a complaint about the study, then please contact Dr Adlam using the above details.

## (6) Parent information sheet (school recruitment)



College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

### How do judgments relate to action in young people?

#### Information Sheet for Parents/Guardians

**(Please keep this copy)**

My name is Kate Littler. I am a trainee clinical psychologist at the University of Exeter who is undertaking a doctorate in clinical psychology. As part of this I am required to conduct a research study. I would like to invite your child to take part. Before you decide whether or not you would like your child to participate, it is important that you understand why the research is being done and what it will involve, so please take time to read this information sheet. Please talk to others about it if you wish, and feel free to ask me any questions if you would like more information or would like to discuss any aspect of the study.

- **What is the study about?**

Previous studies have shown that people's thinking and how they make decisions can affect what action they take. I am interested in how young people make judgments and reason about everyday situations, and how this relates to what they might do in these situations. This study aims to further understand the relationship between young people's thinking and what action they might take in day to day situations.

- **Why has your child been chosen?**

Your child has been invited to participate in this study because their school has agreed to support the research, and they are in the age range required for the study (11-14 years).

- **Does your child have to take part?**

No. It is entirely up to you and your child whether you would like your child to take part or not. This information sheet is to give you more information about the study to help you make a decision either way. Your child is also provided with a child friendly version of this information sheet, so that they can learn more about the study and decide whether they would like to take part. If you do not want your child to take part in the research, simply fill out the enclosed "opt-out" form, and return it to the school. A decision to opt out of the study will not affect your child's education now or in the future. If your child does participate in the study, they are free to withdraw at any time, without giving a reason.

- **What does the study involve?**

If your child decides to take part, they will be invited to attend a one off session with me at school during lesson time. At this session they will have an opportunity to ask any further questions about the study. They will also sign a form to say that they are happy to take part in the study.

In the assessment session, they will be asked to complete a range of tasks. These tasks will include answering questions, participating in puzzles looking at their thinking skills, and filling in questionnaires. The session will last around an hour.

If you are happy for your child to take part in the study, but do not want them participating during school time, then you can contact me and we can arrange an assessment session in a time and place that is convenient to you.

In addition, the researcher will speak to your child's teacher to ensure that they fulfil criteria for inclusion in the study. The researcher will ask the teacher whether the child has a history of brain injury, mental health difficulties, or substance misuse, as unfortunately these children will not be able to take part in the study.

The information collected from your child's teacher and during the tasks will be kept locked in a filing cabinet at the university. The information will be transported by the researcher in a locked brief case. The data will be entered onto a database protected by university password protected systems and saved on an encrypted memory stick if accessed on other computers. The data will never be saved to another computer. **The data will not be identifiable**, as your child's responses will be entered under a number, not by name.

- **Will my taking part be kept confidential?**

Yes. All the information I receive from your child is treated as strictly confidential. Your child's data will be given a code number and will be entered using this onto the computer. The list which links codes to people's identity will be locked separately from the completed assessment measures. No identifiable data will be collected. In accordance with publishing guidelines, the data will be kept securely for 5 years.

- **What are the possible benefits of taking part?**

Although there are not any direct advantages for you or your child of participating in the research, by participating your child is helping us to understand the link between how children think and what they do. The understanding of how these relationships develop in healthy children will help us to understand possible reasons why some children may have difficulties in these areas. It also may eventually allow for the development of programmes that will help children who are struggling in these areas. Often, people enjoy the assessment procedure and thinking about some of the questions that they have been asked.

- **What are the possible disadvantages of taking part?**

The researcher does not envisage any disadvantages or risks of taking part. Some children may find the assessment procedure long, however they can take a break or complete some tests in another session if they want. Tests will be undertaken during school time, so your child may have to miss a lesson. This will be agreed with their teacher. It is highly unlikely that any child would find the procedure distressing. However, in the unlikely event that your child experienced any distress in the assessment session, the session would be terminated, the reasons for distress would be explored, and they would have the option to withdraw from the study, and therefore to have their data destroyed. In the unlikely event that your child feels that they need support as a result of participating in the study, you or your child can contact me on the telephone number at the end of this leaflet.

- **What will happen if I don't want my child to carry on in the study?**

You are free to withdraw your child from the study at any time. You just have to let me know, but you do not have to give a reason. You can decide whether you are happy for data already collected to be processed or if you would like it to be destroyed.

- **What if there is a problem?**

If you have a concern about any aspect of this research you can contact me and I will do my best to answer your questions. Alternatively you can contact my supervisor. If you remain unhappy and wish to complain formally, you can do this through my supervisor at the University of Exeter. Each of these actions can be taken by telephoning the numbers at the end of this information leaflet.

- **What will happen to the study results?**

The research is making up my doctoral thesis. The results will be written up for submission to the University of Exeter. There is the possibility that the results will be published in journals to contribute to the wider literature on the link between thinking and action.

- **Who is organising and funding the research?**

This is being conducted as a thesis, as part of a Doctorate of Clinical Psychology course at the University of Exeter. This study is being supervised by Dr Anna Adlam, Senior Lecturer and Co-Director for the Centre for Clinical Neuropsychology Research. There is no additional funding for the research.

- **Who has reviewed and approved this study?**

This research has been considered by an independent group of people, called a Research Ethics Committee. This study was reviewed by the University of Exeter Ethics board, and was given a favourable opinion.

Thank you for taking the time to read this information sheet.

This is your copy to keep.

I would be extremely grateful for your assistance.

If you would like any further information about this study, please do not hesitate to contact the researcher, Kate Littler:

Email: xxxxxxxxxxxxxx

If you would like to talk to the researcher's supervisor, Dr Anna Adlam of the University of Exeter, then please use the following details;

Email: xxxxxxxxxxxxxx Telephone: xxxxxxxxxxxxxx

If you wish to make a complaint about the study, then please contact Dr Adlam using the above details.

## (7) Parent information sheet (University of Exeter staff newsletter recruitment)



College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

### How do judgments relate to action in young people?

#### Information Sheet for Parents/Guardians

(Please keep this copy)

My name is Kate Littler. I am a trainee clinical psychologist at the University of Exeter who is undertaking a doctorate in clinical psychology. As part of this I am required to conduct a research study. I would like to invite your child to take part. Before you decide whether or not you would like your child to participate, it is important that you understand why the research is being done and what it will involve, so please take time to read this information sheet. Please talk to others about it if you wish, and feel free to ask me any questions if you would like more information or would like to discuss any aspect of the study.

- **What is the study about?**

Previous studies have shown that people's thinking and how they make decisions can affect what action they take. I am interested in how young people make judgments and reason about everyday situations, and how this relates to what they might do in these situations. This study aims to further understand the relationship between young people's thinking and what action they might take in day to day situations.

- **Why has your child been chosen?**

Your child has been invited to participate in this study because they are in the age range required for the study (11-14 years).

- **Does your child have to take part?**

No. It is entirely up to you and your child whether you would like your child to take part or not. This information sheet is to give you more information about the study to help you make a decision either way. Your child is also provided with a child friendly version of this information sheet, so that they can learn more about the study and decide whether they would like to take part. If your child does participate in the study, they are free to withdraw at any time, without giving a reason.

- **What does the study involve?**

If your child decides to take part, they will be invited to attend a one off session with me at a time and place convenient to you. At this session they will have an opportunity to ask any further questions about the study. They will also sign a form to say that they are happy to take part in the study.

In the assessment session, they will be asked to complete a range of tasks. These tasks will include answering questions, participating in puzzles looking at their thinking skills, and filling in questionnaires. The session will last around an hour.

The information collected from your child during the tasks will be kept locked in a filing cabinet at the university. The information will be transported by the researcher in a locked brief case. The data will be entered onto a database protected by university password protected systems and saved on an encrypted memory stick if accessed on other computers. The data will never

be saved to another computer. **The data will not be identifiable**, as your child's responses will be entered under a number, not by name.

- **Will my taking part be kept confidential?**

Yes. All the information I receive from your child is treated as strictly confidential. Your child's data will be given a code number and will be entered using this onto the computer. The list which links codes to people's identity will be locked separately from the completed assessment measures. No identifiable data will be collected. In accordance with publishing guidelines, the data will be kept securely for 5 years.

- **What are the possible benefits of taking part?**

Although there are not any direct advantages for you or your child of participating in the research, by participating your child is helping us to understand the link between how children think and what they do. The understanding of how these relationships develop in healthy children will help us to understand possible reasons why some children may have difficulties in these areas. It also may eventually allow for the development of programmes that will help children who are struggling in these areas. Often, people enjoy the assessment procedure and thinking about some of the questions that they have been asked.

- **What are the possible disadvantages of taking part?**

The researcher does not envisage any disadvantages or risks of taking part. Some children may find the assessment procedure long, however they can take a break or complete some tests in another session if they want. It is highly unlikely that any child would find the procedure distressing. However, in the unlikely event that your child experienced any distress in the assessment session, the session would be terminated, the reasons for distress would be explored, and they would have the option to withdraw from the study, and therefore to have their data destroyed. In the unlikely event that your child feels that they need support as a result of participating in the study, you or your child can contact me on the telephone number at the end of this leaflet.

- **What will happen if I don't want my child to carry on in the study?**

You are free to withdraw your child from the study at any time. You just have to let me know, but you do not have to give a reason. You can decide whether you are happy for data already collected to be processed or if you would like it to be destroyed.

- **What if there is a problem?**

If you have a concern about any aspect of this research you can contact me and I will do my best to answer your questions. Alternatively you can contact my supervisor. If you remain unhappy and wish to complain formally, you can do this through my supervisor at the University of Exeter. Each of these actions can be taken by telephoning the numbers at the end of this information leaflet.

- **What will happen to the study results?**

The research is making up my doctoral thesis. The results will be written up for submission to the University of Exeter. There is the possibility that the results will be published in journals to contribute to the wider literature on the link between thinking and action.

- **Who is organising and funding the research?**

This is being conducted as a thesis, as part of a Doctorate of Clinical Psychology course at the University of Exeter. This study is being supervised by Dr Anna Adlam, Senior Lecturer and Co-Director for the Centre for Clinical Neuropsychology Research. There is no additional funding for the research.

- **Who has reviewed and approved this study?**

This research has been considered by an independent group of people, called a Research Ethics Committee. This study was reviewed by the University of Exeter Ethics board, and was given a favourable opinion.

Thank you for taking the time to read this information sheet.

This is your copy to keep.

I would be extremely grateful for your assistance.

If you would like any further information about this study, please do not hesitate to contact the researcher, Kate Littler:

Email: xxxxxxxxxxxxxx

If you would like to talk to the researcher's supervisor, Dr Anna Adlam of the University of Exeter, then please use the following details;

Email: xxxxxxxxxxxxxx Telephone: xxxxxxxxxxxxxx

If you wish to make a complaint about the study, then please contact Dr Adlam using the above details.

## (8) Teacher information sheet (school recruitment)



College of Life & Environmental Sciences  
 Washington Singer Laboratories  
 Streatham Campus  
 United Kingdom

### How do judgments relate to action in young people?

#### Information Sheet for Teachers

**(Please keep this copy)**

My name is Kate Littler. I am a trainee clinical psychologist at the University of Exeter who is undertaking a doctorate in clinical psychology. As part of this I am required to conduct a research study. The headmaster at your school has agreed to support this research. This information sheet will provide you with some more information about the study. Please feel free to ask me any questions if you would like more information or would like to discuss any aspect of the study.

- **What is the study about?**

Previous studies have shown that people's thinking and how they make decisions can affect what action they take. I am interested in how young people make judgments and reason about everyday situations, and how this relates to what they might do in these situations. This study aims to further understand the relationship between young people's thinking and what action they might take in day to day situations.

- **What young people are eligible for inclusion in the study?**

This study aims to recruit 71 children aged 11-14 years. Unfortunately, young people with a history of developmental disorders, acquired brain injury, mental health difficulties and/or substance misuse will not be able to take part. I will check this information with you concerning any of your pupils who will be included in the study.

- **Do young people have to take part?**

No. It is entirely up to each young person whether or not they want to take part in the research. Parents/guardians will be sent an information sheet about the study, and can withdraw their child from the study. A decision to opt out of the study will not affect the young person's education now or in the future. If the young person does participate in the study, they are free to withdraw at any time, without giving a reason.

- **What does the study involve?**

For pupils who want to take part in the study, and whose parents/guardians have not withdrawn them from the study, an assessment session will be arranged during school time. The researcher will arrange the date of time of this session with you. At this session pupils will have an opportunity to ask any further questions about the study. They will also sign a form to say that they are happy to take part in the study.

In the assessment session, they will be asked to complete a range of tasks. These tasks will include answering questions, participating in puzzles looking at their thinking skills, and filling in questionnaires. The session will last around an hour.

All information the researcher obtains from each pupil will be kept locked in a filing cabinet at the university. The information will be transported by the researcher in a locked brief case. The data will be entered onto a database protected by university password protected systems and saved on an encrypted memory stick if accessed on other computers. The data will never be saved to another computer. **The data will not be identifiable**, as each pupil's responses will be entered under a number, not by name.



- **Will taking part be kept confidential?**

Yes. All the information I receive from pupils is treated as strictly confidential. Pupil's data will be given a code number and will be entered using this onto the computer. The list which links codes to pupil's identity will be locked separately from the completed assessment measures. No identifiable data will be collected. In accordance with publishing guidelines, the data will be kept securely for 5 years.

- **What are the possible benefits of taking part?**

Although there are not any direct advantages to pupils of participating in the research, by participating pupils are helping us to understand the link between how children think and what they do. The understanding of how these relationships develop in healthy children will help us to understand possible reasons why some children may have difficulties in these areas. It also may eventually allow for the development of programmes that will help children who are struggling in these areas. Often, people enjoy the assessment procedure and thinking about some of the questions that they have been asked.

- **What are the possible disadvantages of taking part?**

The researcher does not envisage any disadvantages or risks of taking part. Some children may find the assessment procedure long, however they can take a break or complete some tests in another session if they want. Tests will be undertaken during school time, so pupils may have to miss a lesson. This will be agreed with you. It is highly unlikely that any pupil would find the procedure distressing. However, in the unlikely event that a pupil experienced any distress in the assessment session, the session would be terminated, the reasons for distress would be explored, and they would have the option to withdraw from the study, and therefore to have their data destroyed. In the unlikely event that pupils feel that they need support as a result of participating in the study, they can contact me on the telephone number at the end of this leaflet.

- **What will happen if the pupil wants to withdraw from the study?**

Parents/guardians and the pupils participating can withdraw their participation from the study at any time, without giving a reason. They can then decide whether they are happy for data already collected to be processed, or if they would like it to be destroyed.

- **What if there is a problem?**

If you have a concern about any aspect of this research you can contact me and I will do my best to answer your questions. Alternatively you can contact my supervisor. If you remain unhappy and wish to complain formally, you can do this through my supervisor at the University of Exeter. Each of these actions can be taken by telephoning the numbers at the end of this information leaflet.

- **What will happen to the study results?**

The research is making up my doctoral thesis. The results will be written up for submission to the University of Exeter. There is the possibility that the results will be published in journals to contribute to the wider literature on the link between thinking and action.

- **Who is organising and funding the research?**

This is being conducted as a thesis, as part of a Doctorate of Clinical Psychology course at the University of Exeter. This study is being supervised by Dr Anna Adlam, Senior Lecturer and Co-Director for the Centre for Clinical Neuropsychology Research. There is no additional funding for the research.

- **Who has reviewed and approved this study?**

This research has been considered by an independent group of people, called a Research Ethics Committee. This study was reviewed by the University of Exeter Ethics board, and was given a favourable opinion.

Thank you for taking the time to read this information sheet.

This is your copy to keep.

I would be extremely grateful for your assistance.

If you would like any further information about this study, please do not hesitate to contact the researcher, Kate Littler:

Email: xxxxxxxxxxxxxx

If you would like to talk to the researcher's supervisor, Dr Anna Adlam of the University of Exeter, then please use the following details;

Email: xxxxxxxxxxxxxx Telephone: xxxxxxxxxxxxxx

If you wish to make a complaint about the study, then please contact Dr Adlam using the above details.

## Appendix D: Copies of Assessments

### The Demographics Questionnaire

#### How do judgments relate to action in young people?

#### Demographics Questionnaire

This form is to be completed by the researcher with the young person at the beginning of the assessment session.

Participant's ID Number: .....

Participant's DOB: .....

Age of participant: .....

Sex of participant: .....

Is English the participant's first language?      Y/N

Does the participant have a history of any of the following?

- Developmental disorders?      Y/N
- Acquired brain injury?      Y/N
- Co-morbid mental health disorders? Y/N
- Substance misuse?      Y/N

What is your parents'/guardians' occupation?

.....  
.....  
.....  
.....  
.....

## The Empathy Quotient

Below is a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by circling your answer. There are no right or wrong answers, or trick questions.

1. I can easily tell if someone else wants to enter a conversation.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
2. I prefer animals to humans.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
3. I try to keep up with the current trends and fashions.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
4. I find it difficult to explain to others things that I understand easily, when they don't understand it first time.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
5. I dream most nights.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
6. I really enjoy caring for other people.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
7. I try to solve my own problems rather than discussing them with others.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
8. I find it hard to know what to do in a social situation.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
9. I am at my best first thing in the morning.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
10. People often tell me that I went too far in driving my point home in a discussion.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
11. It doesn't bother me too much if I am late meeting a friend.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
12. Friendships and relationships are just too difficult, so I tend not to bother with them.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
13. I would never break a law, no matter how minor.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
14. I often find it difficult to judge if something is rude or polite.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
15. In a conversation, I tend to focus on my own thoughts rather than on what my listener might be thinking.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
16. I prefer practical jokes to verbal humour.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
17. I live life for today rather than the future.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
18. When I was a child, I enjoyed cutting up worms to see what would happen.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
19. I can pick up quickly if someone says one thing but means another.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
20. I tend to have very strong opinions about morality.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
21. It is hard for me to see why some things upset people so much.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
22. I find it easy to put myself in somebody else's shoes.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
23. I think that good manners are the most important thing a parent can teach their child.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
24. I like to do things on the spur of the moment.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree

25. I am good at predicting how someone will feel.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
26. I am quick to spot when someone in a group is feeling awkward or uncomfortable.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
27. If I say something that someone else is offended by, I think that that's their problem, not mine.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
28. If anyone asked me if I liked their haircut, I would reply truthfully, even if I didn't like it.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
29. I can't always see why someone should have felt offended by a remark.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
30. People often tell me that I am very unpredictable.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
31. I enjoy being the centre of attention at any social gathering.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
32. Seeing people cry doesn't really upset me.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
33. I enjoy having discussions about politics.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
34. I am very blunt, which some people take to be rudeness, even though this is unintentional.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
35. I don't tend to find social situations confusing.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
36. Other people tell me I am good at understanding how they are feeling and what they are thinking.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
37. When I talk to people, I tend to talk about their experiences rather than my own.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
38. It upsets me to see an animal in pain.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
39. I am able to make decisions without being influenced by people's feelings.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
40. I can't relax until I have done everything I had planned to do that day.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
41. I can easily tell if someone else is interested or bored with what I am saying.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
42. I get upset if I see people suffering on news programmes.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
43. Friends usually talk to me about their problems as they say that I am very understanding.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
44. I can sense if I am intruding, even if the other person doesn't tell me.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
45. I often start new hobbies but quickly become bored with them and move on to something else.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
46. People sometimes tell me that I have gone too far with teasing.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
47. I would be too nervous to go on a big rollercoaster.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
48. Other people often say that I am insensitive, though I don't always see why.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
49. If I see a stranger in a group, I think that it is up to them to make an effort to join in.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
50. I usually stay emotionally detached when watching a film.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
51. I like to be very organised in day to day life and often make lists of the chores I have to do.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
52. I can tune into how someone else feels rapidly and intuitively.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree

53. I don't like to take risks.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
54. I can easily work out what another person might want to talk about.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
55. I can tell if someone is masking their true emotion.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
56. Before making a decision I always weigh up the pros and cons.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
57. I don't consciously work out the rules of social situations.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
58. I am good at predicting what someone will do.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
59. I tend to get emotionally involved with a friend's problems.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
60. I can usually appreciate the other person's viewpoint, even if I don't agree with it.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree

## The Children's Version of the Empathy Quotient

Below is a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by circling your answer. There are no right or wrong answers, or trick questions.

1. My child likes to look after other people.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
2. My child often doesn't understand why some things upset other people so much.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
3. My child would not cry or get upset if a character in a film died.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
4. My child is quick to notice when people are joking.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
5. My child enjoys cutting up worms, or pulling the legs off insects.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
6. My child has stolen something they wanted from their sibling or friend.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
7. My child has trouble forming friendships.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
8. When playing with other children, my child spontaneously takes turns and shares toys.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
9. My child can be blunt giving their opinions, even when these may upset someone.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
10. My child would enjoy looking after a pet.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
11. My child is often rude or impolite without realising it.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
12. My child has been in trouble for physical bullying.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
13. At school, when my child understands something they can easily explain it clearly to others.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
14. My child has one or two close friends, as well as several other friends.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
15. My child listens to others' opinions, even when different from their own.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
16. My child shows concern when others are upset.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
17. My child can seem so preoccupied with their own thoughts that they don't notice others getting bored.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
18. My child blames other children for things that they themselves have done.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree

19. My child gets very upset if they see an animal in pain.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
20. My child sometimes pushes or pinches someone if they are annoying them.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
21. My child can easily tell when another person wants to enter into conversation with them.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
22. My child is good at negotiating for what they want.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
23. My child would worry about how another child would feel if they weren't invited to a party.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
24. My child gets upset at seeing others crying or in pain.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
25. My child likes to help new children integrate in class.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
26. My child has been in trouble for name-calling or teasing.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
27. My child tends to resort to physical aggression to get what they want.	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree



## **Instructions for the Contingency Naming Test**

These instructions are copied directly from Anderson, Anderson, Northam, and Taylor, (2000), and are available freely.

### **Administration of the CNT**

#### **Trial 1**

Practice task. Place the practice stimulus card in front of the child. The tester says, *"This is a naming test. In this test I'm going to ask you to name some colors and shapes. The first rule I want you to learn is to name the colors. Let's try some. "Point to appropriate designs and say, "We'll call this color green, this color pink and this color blue." Then ask the child to name the colors. "For practise, name the things in this row using the rule you just learned. Point with your finger to keep your place. Start from this side and move across this way, from left to right. "After the child names all of the practice designs, point to the designs for which uncorrected errors were made, and ask the child to name them. If the child does not spontaneously correct an error, provide the correct response. Record errors or self-corrections (corrected errors). The experimental task is administered when the child completes the row of practice designs successfully (ie. no uncorrected errors), or alternatively, when five practice trials have been administered.*

Experimental task. Place the experimental stimulus card in front of the child. The tester says, *"Now using the rule you just learned, I want you to name the things on this card. Start with the top row, then the middle, and then the bottom moving across this way, from left to right as you go. Go as quickly as you can without making mistakes. Point to each one as you name it. Ready, go."*

Record the time taken, errors and self-corrections.

### Trial 2

Practice task. Return the practice stimulus card and say, *"The next rule for you to learn is to name the shapes, the heavy outside ones."* Point to the appropriate designs and say, *"We will call this one a circle, this one a triangle, and this one a square."* Then ask the child to name the three shapes. *For practise, name the things in this row using the rule you just learned. Point with your finger to keep your place. Start from this side and move across this way"* (from left to right). If the child made any uncorrected errors follow the procedure outlined in trial 1.

Experimental task. Place the experimental stimulus card in front of the child and say, *"Now using the rule you just learned, I want you to name the things on this card. Start with the top row, then the middle, and then the bottom moving across this way, from left to right. Go as quickly as you can without making mistakes. Ready, go."* The instruction to point with the finger, and to go from left to right across the top, middle, and bottom rows, can be continued on this and subsequent trials, or phased out if reminding is not necessary. Record the time taken, errors and self-corrections.

### Trial 3

Practice task. Return the practice stimulus card and say, *"Now I'd like to teach you a trickier rule. To learn this rule you'll have to pay attention to the little shapes inside the bigger ones."* Point to some of the internal shapes. *"The rule goes like this, when the inside shape matches the outside shape, you say the color."* Point to the first design and say, *"These two shapes match so you'd call this green. When the inside shape doesn't match the outside shape, you'd say the shape, the heavy, outside one."* Point to the second design and say, *"These*

*two shapes don't match so you'd call this a triangle."* Point to the first and second designs and ask the child to apply the new rule. Repeat the rule if the child gives incorrect responses and then go through the row of practice designs, following the same procedure used in the earlier trials. Any subsequent errors should be corrected as outlined in trial 1, but in addition, the rule should be repeated.

Experimental task. Place the experimental stimulus card in front of the child and say, *"Now using the rule you just learned, name the things on this card. Try to go quickly without making mistakes, but if you have to slow down so as to not make mistakes, it's better to do it that way"*. Record the time taken, errors and self-corrections.

#### Trial 4

Practice task. Return to the practice stimulus card and say, *"The rules get more difficult as you go along but that makes the test more interesting. This time you'll use the same rule you just learned to name everything except for the ones with backwards arrows over them. When you see a backwards arrow, that means to do it the backwards way. To do it the backwards way, you name the color instead of the shape or the shape instead of the color. That's really tricky so let me show you what I mean"*. Demonstrate the rule for three designs with arrows over them. First, point to the design covering the arrow with a finger and say, *"If the backwards arrow wasn't here you would call this a triangle, because the shapes don't match."* Remove the finger and show the arrow. *"But the backwards arrow is here, and to do it the backwards way you say the color pink instead"*. Repeat for the other two designs with arrows, and then ask the child to name these three designs. Correct and re-explain rule if the child makes an

error. Then go through the practice row of designs, using the same procedures as outlined in trial 1. Repeat the rule as part of the procedure for correcting errors made by the child in practice.

Experimental task. Place the experimental stimulus card in front of the child and say, "*Again using the rule you just learned, name the things on this card. Try to go quickly without making mistakes, but if you have to slow down so as to not make mistakes, it's better to do it that way*". Try to administer the trial even if the child is having difficulty, but discontinue if the child becomes upset, or does not seem to know how to continue. Record the time taken, errors and self-corrections.

## The Strengths and Difficulties Questionnaire

### (1) Self-report version

#### Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of how things have been for you over the last six months.

Your Name .....

Male/Female

Date of Birth.....

	Not True	Somewhat True	Certainly True
I try to be nice to other people. I care about their feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am restless, I cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get a lot of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually share with others (food, games, pens etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get very angry and often lose my temper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am usually on my own. I generally play alone or keep to myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually do as I am told	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I worry a lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have one good friend or more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I fight a lot. I can make other people do what I want	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other people my age generally like me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am easily distracted, I find it difficult to concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am nervous in new situations. I easily lose confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am often accused of lying or cheating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other children or young people pick on me or bully me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I often volunteer to help others (parents, teachers, children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think before I do things	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I take things that are not mine from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get on better with adults than with people my own age	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have many fears, I am easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I finish the work I'm doing. My attention is good	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Your signature .....

Today's date .....

**Thank you very much for your help**

## (2) Parent-report version

**Strengths and Difficulties Questionnaire**

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

Child's Name .....

Male/Female

Date of Birth.....

	<b>Not True</b>	<b>Somewhat True</b>	<b>Certainly True</b>
Considerate of other people's feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restless, overactive, cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often complains of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shares readily with other children (treats, toys, pencils etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often has temper tantrums or hot tempers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rather solitary, tends to play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally obedient, usually does what adults request	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many worries, often seems worried	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has at least one good friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often fights with other children or bullies them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally liked by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Easily distracted, concentration wanders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervous or clingy in new situations, easily loses confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often lies or cheats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Picked on or bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often volunteers to help others (parents, teachers, other children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thinks things out before acting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steals from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gets on better with adults than with other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many fears, easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sees tasks through to the end, good attention span	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signature .....

Date .....

Parent/Teacher/Other (please specify:)

**Thank you very much for your help**

## Appendix E: Ethical Approval

Message of approval from the University of Exeter Psychology Research Ethics Committee.

### Conditions of acceptance

Based on your response (dated 27th April) to the issues raised during the review and communicated to you in Chair's email of 25th April, this application is approved without conditions. We wish you all the best with your research.

## Appendix F: Counterbalance Order for Assessments

### 6-condition balanced Latin Square Design

- 1- WASI-II
- 2- SRM-SF
- 3- AWMA
- 4- CNT
- 5- EQ
- 6- SDQ

---

Participant		Order				
1	1	2	6	3	5	4
2	2	3	1	4	6	5
3	3	4	2	5	1	6
4	4	5	3	6	2	1
5	5	6	4	1	3	2
6	6	1	5	2	4	3

---

This was repeated for the next six participants, and so forth.



## Appendix G: Extended Plan for Data Analysis

### Tests of Normality and Outliers

Outliers were identified following the recommendations of Aguinis, Gottfredson and Joo (2013). Standardised z-scores in excess of  $\pm 3.29$  ( $p < .001$ , two-tailed test) were considered to be outliers (Tabachnick & Fidell, 2014). Multivariate outliers were identified using Mahalanobis distance, with values greater than 15 considered potential multivariate outliers (Barnett & Lewis, 1978). Cook's distance was used to detect influential outliers, with values greater than one considered as potential influential outliers (Cook & Weisberg, 1982).

### Mediation Analysis

Baron and Kenny (1986) describe four steps for establishing mediation (Figure 3):

- **Step one:** the predictor must significantly predict the outcome (path c).
- **Step two:** the predictor must significantly predict the mediator (path a).
- **Step three:** the mediator must significantly predict the outcome, controlling for the predictor (path b).
- **Step four:** establish whether complete or partial mediation is present (path c'). Data support the hypothesis of perfect mediation when the predictor has no association with the outcome when the mediator is controlled for (i.e., regression coefficient  $c' = 0$ ). Data support the hypothesis of partial mediation when the regression coefficient  $c'$

reduces when regressing the predictor on the outcome and mediator, but is different from zero.

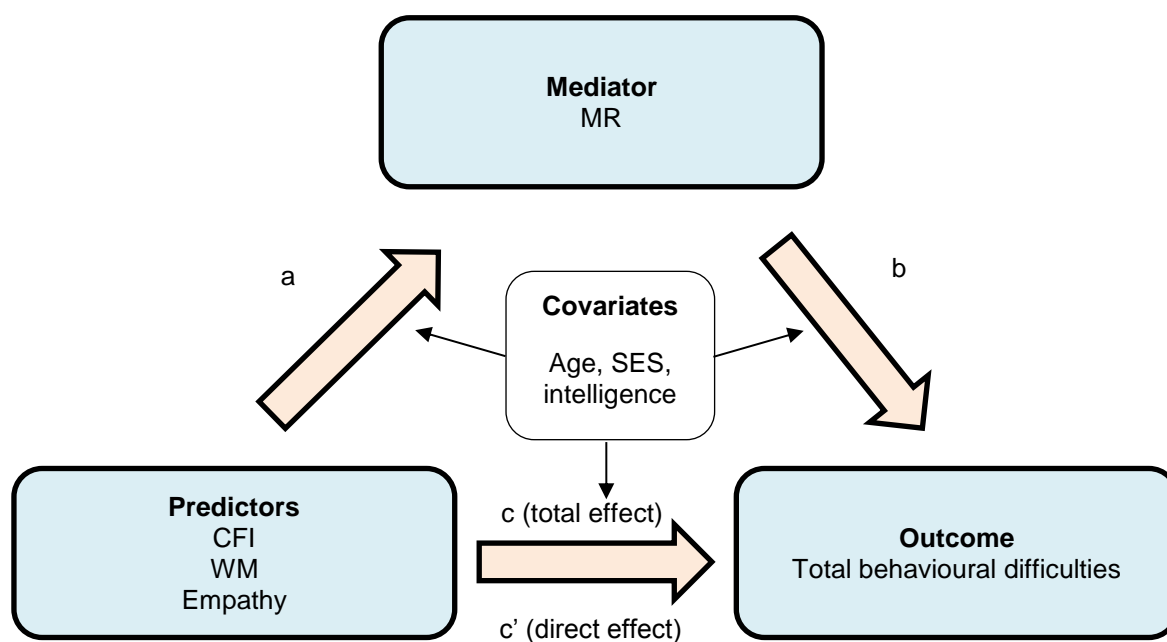


Figure 3. The three mediation models tested in this research.

Hayes (2009) further describes that it is also necessary to test the significance of the indirect effect ( $ab$  path) in order to establish whether mediation is present. Bootstrapping is one method of achieving this, which is recommended in relatively small sample sizes (Preacher & Hayes, 2004, 2008). Furthermore, bootstrapping procedures enable a more accurate determination of statistical significance than other techniques, as they generate an estimate of the sampling distribution of the indirect effect (Hayes, 2013).

Mediation analyses were performed using *MEDIATE* for SPSS, described in Hayes and Preacher (2014). *MEDIATE* permits the generation of bootstrap bias-corrected and accelerated confidence intervals ( $BC_a$ ) to test the significance of the indirect effect.

## Appendix H: Extended Results

### Results for Mediation Analyses Not Controlling for Covariates (Age, SES and Intelligence)

**Hypothesis one.** The hypothesis that MR mediates the relationship between CFI and behaviour independent of covariates was not supported. In step 1 of the mediation model, the regression of the predictor CFI on the outcome behaviour (path c) was not significant,  $b = -1.86$ ,  $t(70) = -0.55$ ,  $p = .586$ . Step 2 showed that the predictor CFI was not significantly associated with the proposed mediator MR (path a),  $b = -4.98$ ,  $t(70) = -0.30$ ,  $p = .765$ . In step 3, the proposed mediator MR was not significantly associated with the outcome behaviour controlling for the predictor CFI (path b),  $b = 0.03$ ,  $t(70) = 1.12$ ,  $p = .267$ . Step 4 of the analyses revealed that the predictor CFI was not significantly associated with the outcome total behavioural difficulties when controlling for the proposed mediator MR (path c'),  $b = -1.72$ ,  $t(70) = -0.51$ ,  $p = .614$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between CFI and behaviour,  $b = -1.14$ ; 95% BC<sub>a</sub> [-1.76, 0.55].

**Hypothesis two.** The hypothesis that MR mediates the relationship between WM and behaviour independent of covariates was not supported. In step 1 of the mediation model, the regression of the predictor WM on the outcome behaviour was not significant (path c),  $b = 0.01$ ,  $t(70) = 0.13$ ,  $p = .898$ . Step 2 showed that the association between the predictor WM on the proposed mediator MR (path a) was significant,  $b = 1.26$ ,  $t(70) = 3.90$ ,  $p < .001$ . In step 3, the proposed mediator was not significantly associated with the outcome behaviour controlling for WM (path b),  $b = 0.03$ ,  $t(70) = 1.19$ ,  $p = .236$ . Step 4 of the analyses revealed that the predictor WM was not significantly associated

with the outcome behaviour when controlling for the proposed mediator MR (path  $c'$ ),  $b = -0.03$ ,  $t(70) = -0.39$ ,  $p = .700$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between WM and behaviour,  $b = 0.04$ ; 95%  $BC_a$  [-0.02, 0.12].

**Hypothesis three.** The hypothesis that MR mediates the relationship between empathy and behaviour independent of covariates was not supported. The regressions in all four steps were non-significant: path a,  $b = 0.44$ ,  $t(70) = 1.43$ ,  $p = .158$ , path b,  $b = 0.03$ ,  $t(70) = 1.18$ ,  $p = .243$ , path c,  $b = -0.01$ ,  $t(70) = -0.14$ ,  $p = .887$ , and path  $c'$ ,  $b = -0.02$ ,  $t(70) = -0.34$ ,  $p = .735$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between empathy and behaviour,  $b = 0.01$ ; 95%  $BC_a$  [-0.00, 0.06].

### Results for Mediation Analysis with Overall EF as the Predictor

“Overall EF” scores were calculated for each participant by averaging the z-scores from CFI and WM assessments. Mediation models were then repeated as described in the Results section, using overall EF as the predictor variable.

The hypothesis that MR mediates the relationship between overall EF and behaviour, controlling for covariates (intelligence, SES and age), was not supported. In step 1 of the mediation model, the regression of the predictor overall EF on the outcome behaviour (path c) was not significant,  $b = 0.71$ ,  $t(70) = 0.73$ ,  $p = .471$ . Step 2 showed that the predictor overall EF was not significantly associated with the proposed mediator MR (path a),  $b = 0.12$ ,  $t(70) = 0.03$ ,  $p = .979$ . In step 3, the proposed mediator MR was not significantly associated with the outcome behaviour controlling for overall EF (path b),  $b = 0.04$ ,  $t(70) = 1.72$ ,  $p = .090$ . Step 4 of the analyses revealed that the predictor

overall EF was not significantly associated with the outcome behaviour when controlling for the proposed mediator MR (path  $c'$ ),  $b = 0.70$ ,  $t(70) = 0.73$ ,  $p = .468$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between overall EF and total behavioural difficulties,  $b = 0.01$ ; 95%  $BC_a$  [-0.31, 0.45], controlling for age, SES and intelligence.

When covariates (age, SES, intelligence) were not controlled for, path  $a$  was statistically significant,  $b = 7.76$ ,  $t(70) = 2.00$ ,  $p = .049$ , therefore, the predictor overall EF was significantly associated with the proposed mediator MR. The remaining paths, however, remained non-significant: path  $b$ ,  $b = 0.03$ ,  $t(70) = 1.23$ ,  $p = .222$ ; path  $c$ ,  $b = -0.21$ ,  $t(70) = -0.25$ ,  $p = .802$ ; path  $c'$ ,  $b = -0.45$ ,  $t(70) = -0.53$ ,  $p = .596$ . Tests of the indirect effect confirmed that MR did not mediate the relationship between overall EF and behaviour,  $b = 0.24$ ; 95%  $BC_a$  [-0.05, 0.88].

### Results for Exploratory Analysis Not Controlling for Covariates

**Associations between sub-domains of MR and behaviour.** To test the second exploratory analysis not controlling for covariates, two-tailed bivariate zero-order Pearson correlations were performed. This revealed no significant associations between MR and behaviour ( $r = .14$ ,  $p = .256$ ), hyperactivity ( $r = .15$ ,  $p = .208$ ), conduct ( $r = .00$ ,  $p = .979$ ), emotional ( $r = .11$ ,  $p = .348$ ), and peer difficulties ( $r = .09$ ,  $p = .433$ ), or pro-social behaviour ( $r = -.07$ ,  $p = .575$ ). TDs were significantly associated with a medium effect size for the law sub-domains of MR ( $r = .36$ ,  $p = .002$ ). TDs were not significantly associated with the contract, truth, affiliation, life, property and legal justice subdomains of MR ( $r$  ranged from .05 to .15,  $ps > .05$ ).

## **Appendix I: Pearson Statement**

The Pearson website states that: “The link with the UK version of the WAIS-IV is straightforward. UK norms for the WAIS-IV are the same as in the US. Therefore, the relationship between the WASI-II and the WAIS-IV will be equivalent in the UK.”

Pearson Publications (2015, April 14). Retrieved from:

<http://www.pearsonclinical.co.uk/Psychology/AdultCognitionNeuropsychologyandLanguage/AdultGeneralAbilities/WASI-II/WechslerAbbreviatedScaleofIntelligenceSecondEdition.aspx>

*Note:* WAIS-IV = Wechsler Adult Intelligence Scale-Fourth Edition.

## Appendix J: Instructions for Authors

### Author Guidelines

#### Journal scope

*Developmental Science* aims to represent the very best of contemporary scientific developmental psychology and developmental cognitive neuroscience, both in the presentation of theory and in reporting new data. *Developmental Science* includes: comparative and biological perspectives, connectionist and computational perspectives, and developmental disorders. *Developmental Science* publishes work that bridges levels of explanation, such as from brain development to cognitive or social change, or work that specifically attempts to elucidate mechanisms of developmental change at one level. Manuscripts judged to fall outside this remit may be rejected without full refereeing.

*Developmental Science* refers to ASAB/ASB ethical Guidelines for the Treatment of Animals in Behavioural Research and Teaching:

<http://asab.nottingham.ac.uk/ethics/guidelines.php>

#### Types of article published in *Developmental Science*

*Developmental Science* publishes two types of manuscripts: (1) *Short Reports* (up to 4,000 words) that are succinct accounts of high impact scientific findings typically involving (but not limited to) a single empirical study or computational model, and (2) *Papers* (up to 8,000 words) that report on more extended empirical or modelling studies.

Some papers judged by the editorial team to present important theoretical issues in developmental science may be selected as *Target Articles* for peer

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Authors wishing that their manuscripts be considered for peer commentary should flag this on submission.

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#### *Speed of Peer Review*

The rapid assessment, as described above, will usually take no more than one working week. The full peer review and *initial* response takes on average 40 days.

#### **Manuscript Preparation**

##### *Word Count*

Depends on type of paper, please see above. The word count does not include



author names and affiliations, acknowledgments, figure captions and references.

### *Style*

The style of the *Publication Manual of the American Psychological Association*, 6th edition, should be followed with respect to handling of references, footnotes, tables and figures, and abbreviations and symbols. Information about the APA guidelines can be found on their website at: <http://www.apastyle.org>

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Authors for whom English is a second language may choose to have their manuscript professionally edited before submission to improve the English. A list of independent suppliers of editing services can be found at [http://authorservices.wiley.com/bauthor/english\\_language.asp](http://authorservices.wiley.com/bauthor/english_language.asp). All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication.

### *References in Articles*

There are several software packages available to help authors manage and format the references and footnotes in their journal article. We recommend the use of a software tool such as EndNote or Reference Manager for reference management and formatting.

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Reference Manager reference styles can be searched for here:

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### *Research Highlights*

Authors are required to submit up to four 'Research Highlights' with their manuscripts. These are bulleted points outlining the key contributions to research the paper makes. The Research Highlights should be placed before the abstract.

### **Preparation of electronic files**

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Manuscripts should be double-spaced throughout. Two versions of your manuscript should be prepared; one 'blinded' version, which should not contain any author identifying information (such as author names, contact details, or acknowledgments), and one full version. When saving the two versions, please indicate which is the blind version (e.g. by adding the word 'blind' to the file name). Please do not include any author names or identifying information as part of the file names. Once we receive your submission, the full (non-blinded version) will be hidden from the reviewers. Although all submitted files are checked, it is the responsibility of the authors to ensure that the blind version does not reveal identifying information.

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Full submission instructions can be found on this website. A cover letter should be submitted with your manuscript and must include a statement that the data have not been published, and are not under consideration for publication elsewhere. It will be presumed that all listed authors of a manuscript have agreed to the listing and have seen and approved the manuscript.

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## **Appendix K: Dissemination statement**

The findings of this thesis will be disseminated through presentation, feedback to participants, and journal publication.

**Feedback to participants.** Schools who took part will be emailed with a summary of the study's findings, as will the parents/guardians of children who took part via the opt-in strategy.

**Journal Publication.** It is expected that the study will be submitted for publication with *Developmental Science*.

**Presentation.** On 8th June 2015, the thesis findings will be presented for peer review to an academic audience, as part of the Doctorate in Clinical Psychology at the University of Exeter.