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**The ability of adults with a learning disability to recognise facial expressions of emotion: is there evidence for the emotion specificity hypothesis?**

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Doctorate in Clinical Psychology

The University of Edinburgh

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## **Portfolio Thesis Abstract**

### **Aims**

Research suggests that people with a learning disability have difficulty processing and interpreting facial expressions of emotion. Emotion recognition is a fundamental skill and impairment in this area may be related to a number of negative, social and functional outcomes including increased frequency of aggressive behaviour, failure of community-based placements and mental illness. This thesis therefore had three aims: to review systematically the evidence for the presence of emotion recognition impairments in adults with a learning disability compared with the non-learning disabled population; to evaluate the emotion specificity hypothesis (which states that people with a learning disability perform less well on emotion recognition tasks as a result of a specific impairment in emotion recognition competence) and to evaluate the relationship between cognitive processing style and emotion recognition in people with a learning disability.

### **Methods**

The first paper is a systematic review of studies that compared the performance of adults with a learning disability with that of a non-learning disabled control group on tasks of facial emotion recognition. The second paper reports on an empirical study that compared the performance of adults with a learning disability (n = 23) with adults (n = 23) and children (n = 23) without learning disability on tasks of facial emotion recognition and control tasks. The third paper reports further results from the empirical study which looks at cognitive processing style of adults with a learning disability and non-learning disabled children and adults.

### **Results**

The systematic review found that all of the included studies reported evidence to support the proposal that adults with a learning disability are relatively impaired in recognising facial expressions of emotion. There are significant limitations associated with the research in this area and further studies are required in order to

provide insight into the possible causes of emotion recognition deficits in this group of people.

In the empirical study, adults with a learning disability were found to be relatively impaired on both emotion recognition and control tasks compared with both adult and child control groups. The availability of contextual information improved emotion recognition accuracy for adults with learning disability. The demands of the task also had an effect: identifying a target emotion from a choice of two images, rather than a choice of nine or naming the emotion also improved accuracy.

Adults with learning disability were more likely to adopt a local processing style. A global processing style was associated with greater accuracy on the emotion recognition tasks.

### **Conclusions**

Adults with learning disability are relatively impaired in facial emotion recognition when compared with non-learning disabled adults and children. This relative impairment was also evident on control tasks and therefore no evidence for the emotion specificity hypothesis was found. A number of issues in relation to future research are raised, specifically regarding the development of control tasks with comparable levels of difficulty to emotion recognition tasks.

## **Journal Article 1: Systematic Review**

### **Title**

**The ability of adults with a learning disability to recognise facial expressions of emotion in comparison with the non-learning disabled population: a systematic review**

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## **Abstract**

### Background

A number of studies have presented evidence to suggest that people with a learning disability have difficulty recognising and interpreting facial expressions of emotion. These studies varied considerably in terms of methodology, most notably in terms of the populations studied, and many studies have focused on groups of people with specific syndromes associated with learning disability. Studies have also used different emotion recognition materials and many did not compare the performance of people with a learning disability against that of the general, non-learning disabled population.

### Objectives

This review systematically examined the available literature on the ability of adults with a learning disability to recognise facial expressions of emotion. The review focused on studies that recruited only adult participants, that did not specifically recruit participants with co-morbid diagnoses of syndrome(s) related to learning disability and that directly compared the performance of adults with a learning disability with a group of people without a learning disability with the aim of determining whether or not impaired emotion recognition is common to adults with a learning disability.

### Methods

Online database searches and searches of reference lists of selected papers led to the identification of nine papers that met eligibility criteria for review. These papers were assessed against pre-defined quality rating criteria and findings were synthesised.

### Results

The majority of included studies were assessed as being of acceptable overall methodological quality. Two studies were given an overall rating of low quality. Studies varied in terms of the emotion recognition materials and task paradigms used

and not all studies used materials with established psychometric properties. All of the studies reported a relative impairment in emotion recognition for participants with a learning disability on at least some of the tasks administered. Calculation of effect sizes, where possible, suggested a large effect size for most significant results. However, two studies found that adults with a learning disability did not differ from a control group on some of the emotion recognition tasks administered.

### Conclusions

There is evidence to suggest that adults with a learning disability are relatively impaired in recognising facial expressions of emotion, when compared with either adults or children without learning disability. Methodological variation between studies limits the extent to which any interpretations can be made as to the cause of impaired emotion recognition in adults with a learning disability.

### Keywords:

Learning disability; intellectual disability; emotion recognition; socio-emotional function

## Highlights

- Impaired ability to recognise emotions can have a number of negative consequences.
- The methodological quality of studies that have examined the emotion recognition capabilities of people with learning disability is varied.
- There is evidence to suggest that adults with a learning disability demonstrate relative impairment in recognising facial emotions when compared with non-learning disabled populations.
- Further research is needed to establish the cause of emotion recognition impairment in people with learning disability.

## **1. Introduction**

The ability to identify and discriminate facial expressions of emotion in others has been studied in a wide range of clinical populations, including people with schizophrenia and depression, among other clinical groups (e.g. Edwards, Jackson & Pattinson, 2002; Leppänen, 2006). As a group, people with a learning disability are widely reported to have impairments in interpersonal and emotional functioning. It has been proposed that the ability to recognise and interpret facial expressions of emotion in others likely plays a fundamental role in the development of socio-emotional competence (McKenzie, Matheson, McKaskie, Hamilton & Murray, 2001; Rojahn, Lederer & Tassé, 1995). As such, there has been a recent interest in examining the emotion recognition capabilities of adults and children with a learning disability. Much of the research in this area has focused on specific groups of people with diagnoses of specific syndromes associated with learning disability, most notably, people with autism spectrum disorder (e.g. Rump, Giovanelli, Minchew & Strauss, 2009). However, other studies have also examined emotion recognition in more heterogeneous groups of people with a learning disability of unknown aetiology (e.g. Gray, Fraser & Leudar, 1983).

### **1.1 Learning disability: Syndrome-specific (behavioural phenotype) studies**

Behavioural phenotype research involves examining behavioural phenomena that are linked with specific genetic syndromes that are associated with learning disability, rather than research with people with learning disability of heterogeneous or unknown aetiology (Zaja & Rojahn, 2008). Syndrome-specific studies of emotion recognition ability within the learning disabled population have primarily focused on people with autism (e.g. Tager-Flusberg, 1999). However, research has also been carried out with other populations, including people with Williams syndrome (Plesa-Skwerer, Faja & Schofield, 2006), Fragile X syndrome (Wishart, Cebula, Willis & Pitcairn., 2007) and Down syndrome (Kasari, Freeman & Hughes, 2001).

### *1.1.1 Autism Spectrum Disorder*

That the emotion recognition capabilities of people with autism have received the greatest amount of attention in this area is perhaps unsurprising, given that autism was originally described as a ‘disorder of affective contact’ (Kanner, 1943) and that the current diagnostic criteria for autism spectrum disorder include items related to deficits in recognising and processing emotion (DSM-IV). However, a review of the research in this area reported inconsistent findings between studies. Some studies provided evidence to suggest that facial emotion recognition is intact in people with autism and others reported that people with autism are significantly impaired at recognising facial emotions (Harms, Martin & Wallace, 2010).

### *1.1.2 Other syndrome-specific studies*

The majority of other studies of people with specific diagnoses involve comparing the emotion recognition abilities of different groups of people with intellectual disability of varying aetiology (Zaja & Rojahn, 2008). For example, Wishart et al., (2007) compared facial emotion recognition in individuals with Fragile X syndrome, Down syndrome, unspecified learning disability and typical development. They found that the group of people with Down syndrome made the most errors on an emotion matching task and the typically developing group made the fewest errors. The group of people with Fragile X syndrome and the unspecified learning disability group did not differ significantly from the typically developing group. Plesa-Skwerer et al. (2006) compared the performance of three participant groups: people with Williams syndrome, people with generic learning disability and typically developing participants on two commonly used measures of facial recognition. They found that the group of participants with Williams syndrome performed equally as well as the people with a learning disability on a measure of emotion identification. However, both groups had significantly lower scores than the group who were following a typical developmental trajectory.

Zaja and Rojahn (2008) have highlighted that, to date, there is no compelling evidence to suggest that there may be significant differences in facial emotion recognition between groups of people with learning disability of varying aetiologies.

However, as discussed by Wishart (2007), in a review, it may be that between-group differences are only noticeable when groups of people with different diagnoses are compared with groups of typically developing individuals. Further research in this area may be important in terms of helping to elucidate the extent and likely cause of emotion recognition impairment common to specific groups of people with learning disability.

## **1.2 Learning disability of unknown aetiology**

A smaller body of research has focused on the emotion recognition abilities of people with learning disabilities without any syndrome-specific diagnosis. One of the first studies to examine the emotion recognition capabilities of people with a learning disability concluded that their performance did not differ significantly from that of psychiatric inpatients and college students (Levy, Orr & Rosenzweig, 1960). However, this study involved simply distinguishing emotions along a happiness-unhappiness dimension and the stimulus materials used were pictures of the same female face, without any established psychometric properties. These factors might have had an impact on the findings of the study. Other, subsequent studies in this area have generally concluded that people with a learning disability of unknown aetiology are impaired in recognising facial emotional expressions. This is true for studies of children with a learning disability, adults with a learning disability and studies that have included a mixed sample of adults and children (McAlpine, Kendall & Singh, 1991; Rojahn, Rabold & Schneider, 1995; Xeromeritou, 1992).

However, studies in this area vary significantly in terms of their methodology. For example, many studies did not recruit any comparison group of participants drawn from the general, non-learning disabled population (e.g. Gray et al., 1983; Simon, Rosen & Ponpipom, 1996). It is therefore difficult to draw any firm conclusions with regard to the presence and extent of any emotion recognition impairment, in comparison to the general population. Some studies recruited mixed-samples of participants, including participants with specific diagnoses related to learning disability (e.g. autism spectrum disorder, Garcia-Villamasir, Rojahn, Zaja & Jodra., 2010; Gioia & Brosgole, 1988) and with concurrent mental health difficulties (e.g.

Rojahn & Warren, 1997; Warren, 1992). Furthermore, the stimulus materials used for the emotion recognition tasks vary considerably between studies. Many studies used photo-based images of human faces (e.g. McAlpine et al., 1991; McAlpine, Singh, Kendall & Ellis, 1992). However, others have used cartoon-based stimuli, such as images of animals expressing different emotions (Weisman & Brosgole, 1994; Matheson & Jahoda, 2005) or schematic line drawings of faces (e.g. McKenzie et al., 2001; Simon et al., 1996). Although the majority of studies used static images, some used moving images, such as videos of adults displaying different emotions (e.g. Moffatt, Hanley-Maxwell & Donnellan, 1995). Thus, the ecological validity of stimuli is rarely known and is likely to have varied between studies and may have had a resulting impact on the results obtained (Moore, 2001). These methodological variations make it difficult to draw any firm conclusions about the presence and extent of any emotion recognition impairment experienced by people with a learning disability.

Nevertheless, there are two main, competing proposals that attempt to explain the observed emotion recognition deficits experienced by people with an intellectual disability. The first of these is that impaired performance on emotion recognition tasks is a reflection of a *specific* impairment in emotion-perception competence, which cannot be accounted for by cognitive-intellectual impairment (Emotion Specificity Hypothesis, Rojahn, Rabold & Schneider, 1995). The second proposal is that basic emotion perception is intact in people with an intellectual disability and, instead, poor performance on emotion recognition tasks is a consequence of poor IQ-related information processing abilities (Moore, 2001). To date, no definitive evidence has been found to support either hypothesis and no studies have sought to examine whether any additional evidence can be found to support the emotion specificity hypothesis, following the study by Rojahn et al. (1995).

### **1.3 Long-term effects of emotion recognition deficits**

More recently, studies have aimed to establish whether there might be any potential long-term implications of impaired emotion recognition for people with a learning disability. Although no longitudinal studies have sought to determine whether a

causal relationship exists between emotion recognition impairment and later antisocial behaviour, some authors have examined this in exploratory, cross-sectional studies (Zaja & Rojahn, 2008). Matheson and Jahoda (2005) expanded upon earlier studies that used de-contextualised photographs of emotions by using stimuli that included both contextualised and de-contextualised images in order to determine whether exhibition of frequent, aggressive behaviour was associated with greater relative impairment in emotion recognition in people with learning disabilities. These authors found that the aggressive group of participants demonstrated poorer emotion recognition when greater contextual information was available, when compared with a nonaggressive group. No significant differences were found when de-contextualised stimuli were used. However, Jahoda, Pert and Trower (2006) subsequently found that aggressive participants did not display a negative emotion bias in facial emotion recognition errors, in contrast with their hypothesis. Similarly, Woodcock and Rose (2007) found no evidence to suggest there was a relationship between self-reported anger levels and performance on facial emotion recognition tasks for people with a learning disability. Thus, although some evidence exists to support the idea that emotion recognition deficits may contribute to antisocial behaviour in groups of people with a learning disability, more recent research does not support this proposal and further studies are needed in this area (Zaja & Rojahn, 2008).

#### **1.4 Previous reviews**

An initial review of emotion research in the area of learning disability was carried out by Rojahn, Lederer & Tassé (1995), who reviewed 21 experimental studies. They discussed the methodological characteristics of these studies, including demographics, design, task paradigms and emotion categories studied, among other variables. These authors also examined evidence regarding the potential relationship between emotion recognition ability and the degree of intellectual impairment, gender, chronological age and mental illness. The review included studies of both adults and children with learning disability and also included studies that recruited people with autism, provided they also recruited a group of participants with learning disability without autism. Rojahn et al. (1995) concluded that people with a learning

disability are impaired in emotion recognition when compared to developmentally normal individuals and that there is an association between emotion recognition ability and cognitive function, with greater levels of cognitive impairment associated with greater relative impairment in emotion recognition. Rojahn et al. (1995) also identified preliminary evidence to support the emotion specificity hypothesis. This evidence was drawn primarily from the main author's own study (Rojahn, Rabold & Schneider, 1995) in which it was found that people with a learning disability were impaired on emotion recognition tasks compared with a mental age matched control group, but performed equally as well as the control participants on a control task that had no emotion recognition component. It was therefore proposed that the difficulties people with a learning disability have with processing visual affective information could not be explained by 'mental' age (i.e. cognitive-intellectual limitations) and instead were more likely to be the result of a specific deficit in recognising and interpreting facial expressions of emotion.

A further literature review was carried out by Moore (2001) who reviewed the evidence for the *specificity* of emotion recognition deficits in people with a learning disability. The review provided detailed consideration of the information-processing demands of the different types of emotion recognition tasks used in studies in this area and concluded that the emotion specificity hypothesis was not supported by evidence from tasks involving *identification* of emotions. Rather, it was proposed instead that the observed impairments on other types of emotion recognition tasks shown by groups of people with learning disability could be explained by IQ-related factors that included deficits in memory, attention and imagination. Moore (2001) also highlighted the possible impact of using static emotion recognition task stimuli, with questionable ecological validity.

Neither of the literature reviews described above was systematic in nature. That is, neither reported using a transparent, systematic search strategy nor rated the methodological quality of selected studies according to pre-defined quality appraisal criteria. These reviews therefore did not meet the current recommendations for carrying out a systematic literature review, such as those recommended by the Centre

for Reviews and Dissemination (CRD, 2009). Furthermore, the review by Moore (2001) focused primarily on evaluating the information processing demands of emotion recognition task paradigms used in different studies, and did not review the methodological quality of the studies per se.

### **1.5 Systematic review rationale and aims**

The current systematic review aims to establish whether adults with a learning disability of unknown aetiology are impaired in recognising facial expressions of emotion, in comparison with the non-learning disabled population. Previous reviews in this area examined evidence from studies involving both adults and children with a learning disability (Moore, 2001, Rojahn, Lederer & Tassé, 1995). There is some evidence to suggest that, in typically-developing children, the ability to decode facial expressions of emotion improves throughout childhood and into adolescence (Thomas, De Bellis, Graham & LaBar, 2007; Vicari, Reilly, Pasqualetti, Vizzotto & Caltagirone, 2000). It is therefore possible that, if a similar pattern is present in children with a learning disability, studies with mixed samples of adults and children may provide an inaccurate estimate of the extent of any emotion recognition impairment. This is most likely to be the case for studies that do not include an adequate control group.

The present review, therefore aims to improve upon the methodology of previous reviews by adhering closely to published guidelines for carrying out systematic reviews (e.g. CRD, 2009). Additionally, the current review aims to include more specific inclusion and exclusion criteria in order to control for confounding methodological characteristics between studies. These criteria include controlling for the potential impact of heterogeneous experimental groups that include participants with comorbidities or mixed samples of adults and children with a learning disability. The present review included only studies that recruited a comparison group against which the performance of the learning disability group could be evaluated. The aim is that this will allow for more definitive conclusions regarding the presence and extent of any emotion recognition impairment in adults with learning disability of unknown aetiology to be drawn.

## 2. Methods

The review was conducted based on guidance published by The Centre for Reviews and Dissemination (CRD, 2009 <http://www.york.ac.uk/inst/crd/>) for systematic review methodology and reporting. A systematic review protocol was developed prior to undertaking the review (Appendix 2). This protocol predefined the review question, inclusion and exclusion criteria, detailed the search strategy, data extraction and quality assessment processes and data synthesis and plans for dissemination of results.

### 2.1 Inclusion and Exclusion Criteria

Studies from any publication date were eligible for inclusion in the review. Only studies for which the abstract or full-text was available were included and conference abstracts, book chapters, book reviews and unpublished dissertations/theses were not eligible for inclusion in the review. Articles that were unavailable in English were excluded, due to a lack of resources to facilitate translation.

Key inclusion criteria were based on the ‘PICOS’ framework (Population, Intervention, Comparators, Outcomes and Study Design; CRD, 2009):

#### *Population*

Studies were included if the participants included a group of adults ( $\geq 18$  years) who were described as having a learning disability (or equivalent term).

#### *Intervention*

Criteria required that the emotion recognition tasks used involved static, pictorial images (e.g. line drawings or photographs) that required identification of facial expressions of emotion.

#### *Comparisons*

Studies were eligible for inclusion in the review if at least one control group of participants without a learning disability was recruited.

### *Outcomes*

Studies were included if they quantitatively evaluated responses to any emotion recognition task(s) that met the criteria discussed above.

### *Study Design*

Eligible studies used a quantitative evaluative design. Single case descriptions and studies without any comparison/control group were excluded from the review.

The main inclusion and exclusion criteria for the review are summarised in Table 1.

Table 1. Eligibility criteria for systematic review

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
<p>Participants with a learning disability</p> <p>Adults aged 18 years and above</p> <p>Published peer-reviewed articles</p> <p>Full-text available</p> <p>Article available in English</p> <p>All years considered</p> <p>Control group of participants without an LD included</p> <p>Emotion recognition task includes static, picture-based images (e.g. line drawings, photographs etc.)</p>	<p>Full-text unavailable</p> <p>Qualitative studies</p> <p>Experimental group is solely comprised of children with a learning disability</p> <p>Experimental group includes children with a learning disability and analyses carried out on group as a whole.</p> <p>Participants with specific syndromes related to learning disability are included (e.g. participants with Autism Spectrum Disorder, Down Syndrome etc.)</p> <p>Conference abstracts</p> <p>Book chapters</p> <p>Unpublished dissertations and theses</p> <p>Article unavailable in English</p> <p>Single case descriptions</p> <p>Study does not include any control/comparison group of participants without an LD.</p> <p>Duplicate record</p>

## 2.2 Search Strategy

The overall search process is illustrated diagrammatically in Figure 1, which is a flowchart based on the PRISMA statement (Moher, Liberati, Tetzlaff & Altman, 2009).

### 2.2.1 Database searches

Keyword searches were conducted of the following electronic databases: Medline, CINAHL Plus, EMBASE, SCOPUS and PsychINFO using the search terms (*learning disab\* or intellectual disab\* or mental retardation or intellectual impairment or developmental disab\* or learning disorder or mental handicap*) AND (*emotion recognition or affect recognition or facial recognition or facial perception or facial expression*) within the domains of title, abstract and keyword/subject heading. All publication years provided by the databases, up until the date of the search (9<sup>th</sup> April 2014) were included. A total of 2631 records were identified using this search strategy. Exact duplicate records were removed, and this reduced the number of records to 1970.

Titles of the identified records were screened against the eligibility criteria and studies that were clearly irrelevant were excluded. The abstracts of the remaining studies (n = 107) were then screened according to the aforementioned eligibility criteria and this resulted in a further 79 articles being excluded. The reasons for excluding these articles are summarised in Figure 1. Full-text articles were obtained and reviewed for studies that were not excluded on the basis of abstract review. Those papers that were found to meet the eligibility criteria were included in the systematic review (n = 8).

### 2.2.2 Reference list searches

The reference lists of three previous, similar reviews were also manually searched in order to identify any relevant studies that may not have been identified by the database searches (Moore, 2001; Rojahn et al., 1995; Zaja & Rojahn, 2008). The reference lists of studies that were found to meet inclusion criteria were also searched. This process yielded a total of three potentially eligible papers that were

screened for inclusion. One of these studies was subsequently found to meet inclusion criteria and was included in the review (Owen, Browning & Jones, 2001).

### *2.2.3 Included studies*

Therefore, a total of nine studies, conducted between the years of 1987 and 2001 met the criteria for inclusion in the systematic review. A summary of the key findings from each study are presented in Table 2.

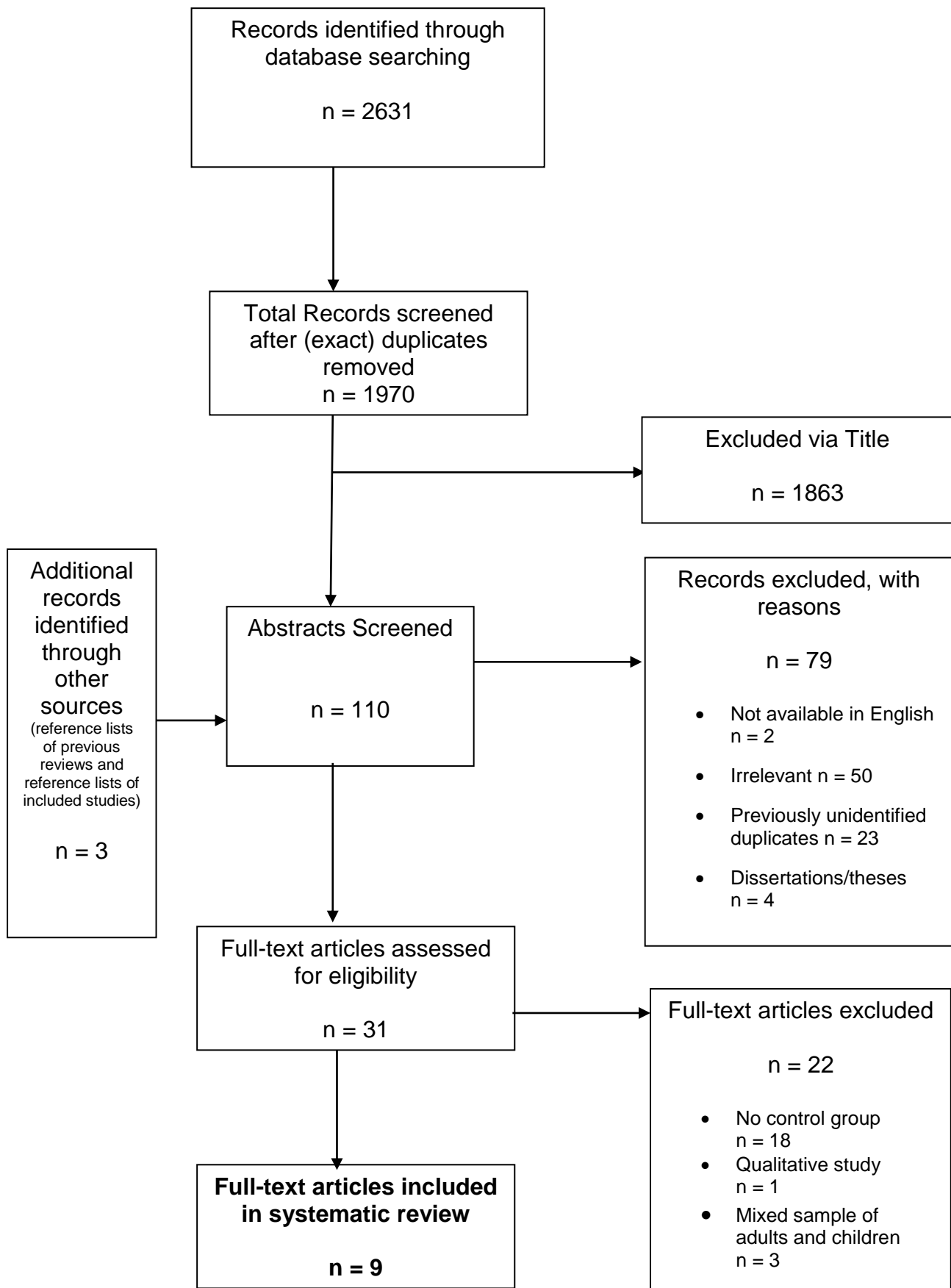


Figure 1. Flowchart illustrating systematic search process

### **2.3 Quality rating of studies**

Included studies were assessed using quality criteria which were devised based on guidance from The Centre for Reviews and Dissemination (CRD, 2009) and the Scottish Intercollegiate Guidelines Network's guidance on systematic reviews, ANNEX-C (SIGN, 2014). Articles were rated on ten criteria from the following five categories: study design and risk of bias, outcome measures, quality of intervention, statistical issues and generalisability.

A detailed rating procedure was used to assign each study with a quality rating score. This rating system was based on the Scottish Intercollegiate Guidelines Network's guidelines for Cohort studies (SIGN, 2014). The following descriptors were assigned to each of the quality criteria: 'well covered', 'adequately addressed', 'poorly addressed', 'not addressed', 'not reported' and 'not applicable'. Definitions were created for each descriptor within each of the quality criteria, in order to inform the quality assessment process (Appendix 3).

Table 2. Summary of included studies

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
Harwood, Hall & Shinkfield (1999)	To establish whether facial emotion recognition by individuals with 'mental retardation' is affected by the movements involved in the production of emotional expressions.	<p>n = 12</p> <p><u>Age range:</u> 19-54 years</p> <p><u>Sex:</u> 8 male, 4 female</p> <p><u>Recruitment:</u> "Volunteers with mild mental retardation".</p> <p>WAIS-R FSIQ scores between 56 - 73.</p>	<p>n = 12</p> <p><u>Age range:</u> "matched with LD group".</p> <p><u>Sex:</u> "matched with LD group".</p> <p><u>Recruitment:</u> Recruited from general community.</p>	<p><u>Photographic task:</u> Coloured photographs of adults and children displaying six emotions along with labels of each emotion (developed by Mazurski and Bond, 1993). Participants were shown the six child photographs, with the corresponding emotion label under each photograph and told what the emotion was. Then asked to identify the corresponding adult photograph. Inter-rater agreement 92% - 100%</p> <p><u>Videotape task:</u> Participants shown static images and asked to identify emotion shown, by choosing from emotion labels or pictorial representations (e.g. a snake and spider representing fear). 12 displays that had 100% agreement for the type of emotion and at least 67% agreement that the emotion was average intensity.</p>	The learning disability group had significantly lower scores on the photographic task and the static videotape task than the control group (p < 0.001).

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
Leung & Singh (1998)	To determine whether Chinese adults with learning disability show deficits in the ability to recognise facial expressions of emotion.	<p>n = 6</p> <p><u>Age range:</u> 20-51 years</p> <p><u>Sex:</u> 33 male, 27 female</p> <p><u>Recruitment:</u> From a 'sheltered workshop'.</p> <p>n = 30 'mildly retarded' and n = 30 'moderately retarded'</p>	<p>n = 60 children</p> <p><u>Age range:</u> 8 – 15 years</p> <p><u>Sex:</u> 30 male and 30 female</p> <p><u>Recruitment:</u> From an elementary school and a junior high school.</p>	<p>Four sets of six photos selected from original set developed and validated by Ekman and Friesen (1975). Black and white photos depicting each of the six basic emotions (happy, sad, angry, disgust, fear and surprise).</p> <p>For each set, 6 photos shown and short story read, stating a specific emotion. Participant then asked to point to the face that shows that emotion.</p> <p>Inter-rater reliability check on 25% of responses. (99.5%).</p>	<p>No relationship between age or IQ and ability to recognise emotions.</p> <p>Overall, performance of children without LD (77%) was superior to that of adults with LD (52%).</p> <p>Happiness easiest recognised by both groups.</p> <p>The child group were significantly better at recognising the other five emotions than the adult LD group.</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
Maurer & Newbrough (1987)	To examine the ability of adults with learning disability (LD) and adults without learning disability to recognise emotional states in young children with and without learning disability.	<p>n = 32.</p> <p><u>Age range:</u> 24 – 62 years (mean 31.3)</p> <p><u>Sex:</u> 18 male and 14 female.</p> <p><u>Recruitment:</u> Recruited from "two highest functioning groups in a sheltered workshop".</p> <p>Mean IQ 54.4 (range 31 - 72).</p>	<p>n = 23.</p> <p><u>Age range:</u> 21 – 61 years (mean 34.3)</p> <p><u>Sex:</u> 11 male and 12 female</p> <p><u>Recruitment:</u> Recruited from church groups and people known to authors.</p>	<p>2 sets of slides of 32 images: (i) 'retarded children' (ii) 'nonretarded children'</p> <p>For each set, participants asked to identify the emotions displayed in the slides using only the labels 'happy, sad, mad or just okay'.</p> <p>Set (i): Authors created the set of images of 'retarded children' showing different mood states (happiness, anger, sadness, neutrality). Included images were ones with at least 75% level of agreement among 50 judges regarding what emotion displayed was.</p> <p>Set (ii): slides used in 2 previous studies. Show 8 children aged 4-5 years expressing four emotional states (happiness, anger, sadness, neutrality).</p>	<p>Adults without LD were more accurate than the adults with LD in identifying all images, other than sadness.</p> <p>Adults with LD were least accurate in recognising neutral affect.</p> <p>Adults with LD confused sadness and anger most often. Happiness was easiest to identify, for both participant groups.</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
McAlpine, Kendall & Singh (1991)	To investigate the extent of the emotion recognition deficit in a large sample of children and adults at all levels of 'retardation', compared with a group of children without any disability.	<p>n = 194 adults</p> <p><u>Age range:</u> 19-67 years, (mean 33 yrs.)</p> <p><u>Sex:</u> 61% male and 39% female</p> <p><u>Recruitment:</u> From the community and a public residential facility.</p> <p>Level of ability ranged from 'borderline intelligence' to 'profound learning</p>	<p>n = 128 children</p> <p><u>Age range:</u> 5 – 6 yrs. and 8 – 13yrs (mean 9.5yrs)</p> <p><u>Sex:</u> 48% male and 52% female</p> <p><u>Recruitment:</u> From an elementary school and a junior high school.</p>	<p>Six sets of photographs depicting the 6 basic emotions (36 total): enlargements of a set of photographs developed and normed by Ekman &amp; Freisen (1975).</p> <p><u>Emotion recognition task:</u> Participants were required to identify one photograph from a set of six that included the target emotion. Participants were read short stories in a random order (e.g. "If a person was given a present they had always wanted for their birthday.....can you show me the face of the person who is happy?")</p>	<p>Less than 1% of control group (school children), but 80% of adults with LD incorrectly recognised 50% or fewer of the pictured emotions.</p> <p>When only participants who demonstrated an understanding of the 6 basic emotions on screening task were included, less than 1% of the control group but 66% of adults with LD incorrectly recognised 50% or fewer of the emotion pictures.</p> <p>As a group, adults with LD recognised disgust, anger and sadness on</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
		disability’.			approx. 46% of occasions, with surprise and fear the least recognised emotions (39%). Happiness was recognised most often (84%).
McAlpine, Singh, Kendall & Ellis (1992)	To investigate further the ability of individuals with ‘mental retardation’ to decode facial expressions of emotions.	n = 40 adults <u>Age range:</u> Not reported  <u>Sex:</u> Not reported  <u>Recruitment:</u> Diagnosis based on American Association on Mental Deficiency criteria. Recruited from community training centres/	n = 80  <u>Age range:</u> Not reported  <u>Sex:</u> Not reported  <u>Recruitment:</u> Chosen from a large pool of available subjects and matched with LD group on mental age and sex.	Six sets of photographs portraying each of the six basic emotions: anger, disgust, fear, happiness, sadness and surprise (developed and normed by Ekman & Freisen, 1975).  Emotion <i>recognition</i> task was used: Participants were required to identify one photograph from a set of six that included the target emotion. Participants were read short stories in a random order (e.g. “If a person was given a present they had always wanted for their birthday.....can you show me the face of the person who is happy?”)	Adults with LD as a group were significantly less accurate in identifying all 6 emotions compared with mental age matched control group.  Ability to recognise emotions was related to IQ: sadness, fear and disgust were significantly more difficult for ‘moderate’ LD group to identify,

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
		institutional setting.			compared with 'mild LD group.
McKenzie, Matheson, McKaskie, Hamilton & Murray (2001)	To compare the overall emotion recognition ability of individuals with a learning disability and children without a learning disability.	<p>n = 68</p> <p><u>Age range:</u> 19-62 years (Mean 35, SD 11.62).</p> <p><u>Sex:</u> 28 female, 40 male.</p> <p><u>Recruitment:</u> No detail given.</p> <p>n = 18 'mild LD', n = 48 moderate LD, n = 2 severe LD.</p>	<p>n = 68 children</p> <p><u>Age range:</u> 3-11 years (mean 7, SD 1.98)</p> <p><u>Sex:</u> 28 female, 40 male.</p> <p><u>Recruitment:</u> No detail given.</p>	<p>Three sets of materials depicting six emotions (happy, sad, afraid, angry, bored and worried).</p> <p>- line drawings, photographs of the face only and photographs of emotions in context.</p> <p>For each set of materials, participants were asked to:</p> <p>(i) name the emotion, (ii) identify target emotion from a choice of six and from choice of two.</p>	<p>LD group performed on emotion recognition tasks than mental age and sex matched controls, on all sets of materials.</p> <p>Both groups were more accurate on tasks where more contextual information was available.</p> <p>Increasing accuracy was related to increasing intellectual ability.</p> <p>'Happy' was easiest emotion to identify for both participant groups on all tasks. 'Worried'</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
					was most difficult to identify for both participant groups.
Owen, Browning & Jones (2001)	To combine the categorical and dimensional approach to the study of emotion, and examine emotion recognition abilities of adults with mild-moderate learning disabilities across a range of situations (in facial expressions, affective stories, and personal memories) in terms of both emotion categories and emotion	<p>n = 6</p> <p><u>Age range:</u> Not reported (mean 30 years, SD 9.9)</p> <p><u>Sex:</u> 3 male and 3 female</p> <p><u>Recruitment:</u> All classified as having mild-moderate LD (IQ 45-74).</p>	<p>n = 6</p> <p><u>Age range:</u> Not reported (mean 36 years, SD 8.6)</p> <p><u>Sex:</u> 3 male and 3 female</p> <p><u>Recruitment:</u> Recruited from among volunteers from Psychology and an LD Service.</p>	<p>Ekman and Freisen (1976) photographs used for tests 1 and 2.</p> <p><u>Test 1 (Recognition of facial emotion: emotion categories):</u> Photographs shown one at a time and participants were asked whether each picture showed a happy, sad, angry, afraid, surprised or disgusted expression.</p> <p><u>Test 2 (Recognition of facial emotion: emotion dimensions):</u> Participants were asked to identify dimensions (is the feeling shown a pleasant ('nice') or unpleasant ('nasty') one/arousing ('exciting') or unarousing ('calm') one).</p> <p><u>Test 3</u> – not relevant to review criteria.</p>	<p><u>Test 1:</u> LD group had significantly lower scores than the control group.</p> <p><u>Test 2:</u> No significant group differences in recognising the valence (pleasant-unpleasant) but LD group significantly lower scores on arousal ratings than control group.</p> <p><u>Test 4:</u> LD group had lower mean scores but difference only approached significance (p =</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
	dimensions.			<p><u>Test 4 (Recognition of emotion in stories: emotion categories)</u> Twelve emotional stories, adapted from those developed by Stewart &amp; Singh (1995). Participants were asked to identify which of the 6 emotions they would feel if the situation happened to them.</p> <p><u>Test 5 (Recognition of emotion in stories: emotion dimensions)</u> – As in Test 4, but using emotion dimensions (pleasant-unpleasant and arousing-unarousing).</p>	0.059).  <u>Test 5:</u> No difference between mean scores on recognising emotional valence (pleasant-unpleasant) but LD group scored significantly lower on arousal ratings.
Rojahn, Rabold & Schneider (1995)	To test further the emotion specificity hypothesis, which states that mental retardation is associated with deficits in decoding facially expressed	<p>n = 16</p> <p><u>Age range:</u> Not reported</p> <p><u>Sex:</u> 7 male and 9 female.</p>	<p>2 control groups.</p> <p><u>'Mental age matched' control group:</u> n = 16</p> <p><u>Age range:</u> 6.5 - 12 years.</p>	<p><u>Facial Discrimination Task:</u> Comprises two subtasks: emotion task and age discrimination (control) task.</p> <p><u>Emotion Task:</u> Contains 40 black and white randomly sequenced photos of faces. Additionally, interspersed at</p>	On the emotion task, the LD group performed significantly less well than the child and adult control groups (p < 0.01), whereas the two control groups were not statistically

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
	emotions which cannot fully be accounted for by mental age.	<p><u>Recruitment:</u> Recruited from among employees at a sheltered workshop.</p> <p>WAIS FSIQ scores 40 - 70.</p>	<p><u>Sex:</u> 7 male and 9 female</p> <p><u>Recruitment:</u> Recruited from private denominational elementary school.</p> <p><u>Adult control group:</u> n = 16</p> <p><u>Age range:</u> Not reported</p> <p><u>Sex:</u> 11 male and 5 female</p>	<p>regular intervals are 5 cue cards, prompting subjects to rate their mood.</p> <p>Participants were required to indicate whether a given item depicted a happy face, sad face or a face that was neither happy nor sad. If the answer given was happy or sad, subject was required to decide whether 'a little' or 'a lot' happy or sad.</p> <p>Rojahn et al (1994) previously demonstrated that the tasks can be performed by people with 'mild-moderate' LD. Mean retest reliability was .79 on emotion task and .63 on the age (control) task.</p>	<p>different from one another.</p> <p>On the age task, the LD group and the child control group did not differ significantly but both performed less well than the adult control group (p &lt; 0.001).</p>

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
			<u>Recruitment:</u> Selected from a larger database of control participants.		
Weisman & Brosgole (1994)	To determine whether increasing the number of words used for verbal prompting in an affect recognition task has a negative impact on performance by people with a learning disability.	n = 30  <u>Age range:</u> 21 - 44 years  <u>Sex:</u> 16 male and 14 female  Divided into two experimental groups: 'mildly retarded' and 'moderately retarded'.	n = 15 children  <u>Age range:</u> 4 – 6 years  <u>Sex:</u> 7 male and 8 female  Mean chronological age matched to mean mental age of LD group.	<u>Facial stimuli:</u> Cartoon drawings of a bird, chipmunk and dog, each with a neutral, happy, sad and angry expression. Neutral drawings were used for screening purposes and the drawings with affective expressions were used throughout the experimental conditions. Participants were shown a happy, sad and angry drawing simultaneously on each trial. The three sets of faces (bird, chipmunk, and dog) were presented in blocks of 6 trials each and participants were asked to point to the happy, angry or sad face in each trial.	No significant difference between the groups when asked directly to point to the picture showing a specific emotion (p = 0.12).  Vignettes: LD group performed significantly less well than control group only in the condition when long vignettes (with tag lines) were used (p < 0.01).

Author(s), Year	Aims of study	Participants with a learning disability (n, age, sex, info. re: learning disability, how recruited)	Control/ comparison group(s) (n, age, sex, how recruited)	Emotion recognition measure(s) (relevant to systematic review)	Key results relevant to systematic review
		<u>Recruitment:</u> Lived in community, with family or in group homes.		Test materials previously used with people with LD and young children without LD (Brosgole et al., 1986; Gioia & Brosgole, 1988).  <u>Vignettes:</u> Same stimuli described above, but either a short or long vignette was read, with or without affective content explicitly stated at the end.	

## 2.4 Quality of included studies

An overview of the ratings assigned specifically to each study for each of the ten quality criteria are presented in Appendix 4. The rating scale used does not allow for direct comparison across studies; however the overall methodological quality of each study was rated according to the recommendations made by the SIGN guidelines for cohort studies (SIGN, 2014). These guidelines state that a rating of *High Quality* (++) should be assigned to studies where the majority of criteria are met and have little or no risk of bias. A rating of *Acceptable* (+) was assigned to studies that met most of the criteria, where there were some flaws in the study with an associated risk of bias. A rating of *low quality* (0) was assigned to studies where either most criteria were not met or the study had significant flaws related to key aspects of the study design (SIGN, 2014). Two studies were given a *low quality* rating (Maurer & Newbrough, 1987; Weisman & Brosgole, 1994). This was because these studies were rated as ‘poorly addressed’ on a number of the quality criteria, including the criterion that described the psychometric properties of the emotion recognition measures used. The remaining seven studies were rated as being of *acceptable* quality as they were assigned a rating of ‘adequately addressed’ for most of the quality criteria.

Figure 2 shows the percentage of selected studies assigned a rating of ‘well covered’, ‘adequately covered’ and ‘poorly covered/not covered’ for each of the pre-defined quality criteria. As shown by Figure 2, the quality criteria that were best met by the majority of studies included criteria that addressed whether the study had a clearly focused research question, issues related to sampling and the representative nature of participants and the inclusion of at least one appropriate control group. Studies varied in terms of the extent to which they met the quality criterion regarding the use of emotion recognition materials that have been previously used with people with learning disability and/or with acceptable psychometric properties. Quality criteria that were met less often by the majority of studies include the reporting of inclusion and exclusion criteria, giving detail about the criteria used to diagnose learning disability, the use of a control task and addressing inter-rater reliability. The criterion

related to sample size and power was also less well met overall: several studies were underpowered and/or did not report detail regarding any power calculation.

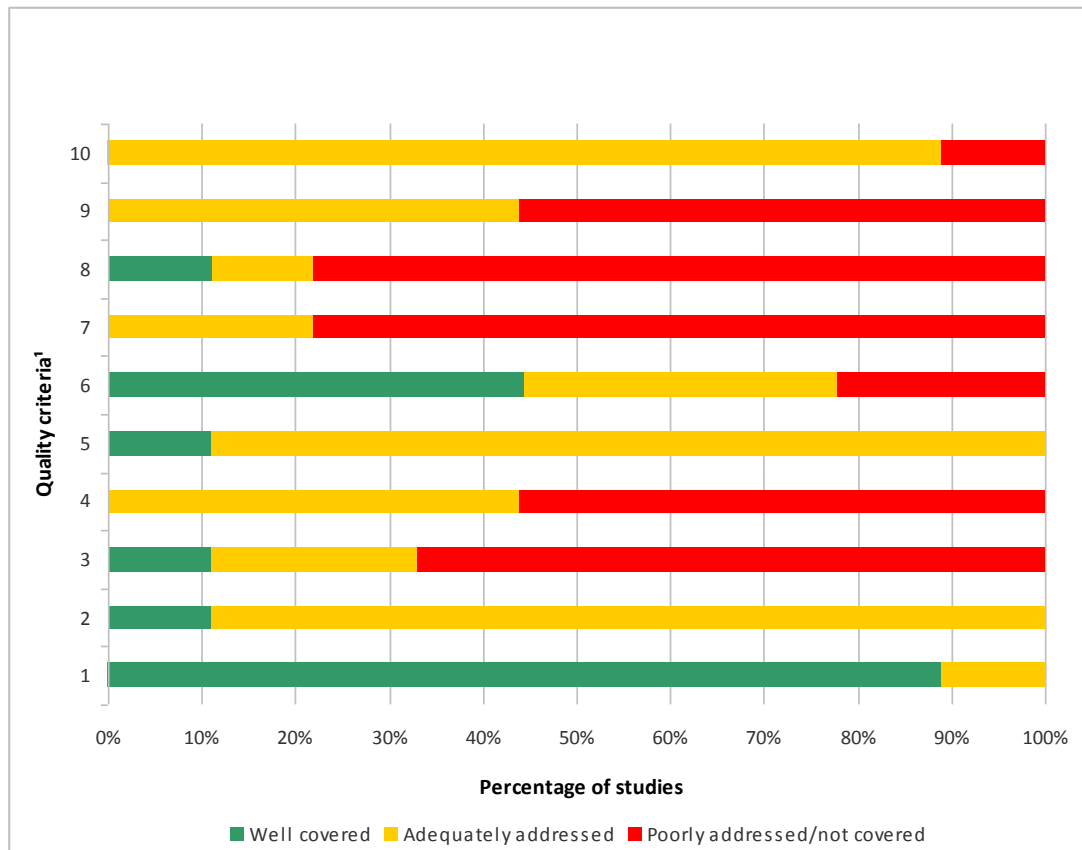


Figure 2. Percentage of studies assigned to each quality rating descriptor for each of the quality criteria.

<sup>1</sup>Quality Criteria

1. The study addresses a clearly focused question, drawn from a theoretical model or previous research
2. Sampling: the characteristics of the participants are representative of the group being studied
3. Inclusion/exclusion criteria are reported and are appropriate in order to avoid confounds or bias
4. Participants: detail is given about the criteria used to diagnose learning disability
5. The study has an adequate control group
6. The emotion recognition measure used is reliable, valid and standardised
7. A control task is used
8. Inter-rater reliability is addressed
9. Sample size and power are adequate
10. Appropriate analyses are carried out and confidence intervals, effect sizes and p-values are reported, where appropriate.

### **3. Results**

#### **3.1 Design**

##### 3.1.1. Participant Characteristics

The studies recruited a total of 458 adult participants with a learning disability. Two hundred and forty-three participants were reported to be male (58%) and 175 (42%) were female. One study did not provide any information about the sex of the participants (McAlpine et al., 1992).

The reported age range of participants with a learning disability was 19 – 67 years. One study reported only the mean age and standard deviation of the participants (30 years, SD 9.9; Owen et al., 2001) and two studies did not report any data regarding the age of the participants with a learning disability (McAlpine et al., 1992; Rojahn et al., 1995).

##### 3.1.2 Sampling

Only one study provided information to suggest that their participants were a representative sample of the general population of people with learning disability of unknown origin (Weisman and Brosigole, 1994). Other included studies reported that the participants with a learning disability were recruited from a single source, such as a ‘sheltered workshop’ and, as such, they were likely to be a somewhat selected sample (e.g. Maurer & Newbrough, 1987; Leung & Singh, 1998; Rojahn et al., 1995). Other studies included a small number of participants in the learning disability group whose level of functioning fell within the ‘borderline’ range of ability (i.e. full-scale IQ score > 70; Harwood et al., 1999; McAlpine et al., 1991; Owen et al., 2001). A further study did not provide any information regarding the IQ range of participants (McAlpine et al., 1992) and another did not report detail about methods used to recruit participants (McKenzie et al., 2001).

### 3.1.3 Diagnosis of Learning Disability

The majority of included studies did not give any specific information regarding the diagnostic process for the participants in the learning disability group (Maurer & Newbrough, 1987; McAlpine et al., 1991; McAlpine et al., 1992; McKenzie et al., 2001; Leung & Singh, 1998). The remaining four studies gave some information regarding the measures used to assess participants full-scale IQ and these were reported to be measures with well-established psychometric properties (e.g. Wechsler Adult Intelligence Scales).

### 3.1.4 Inclusion/Exclusion Criteria

The majority of included studies either did not make any reference to having any pre-defined inclusion/exclusion criteria or the criteria used did not address relevant variables known to impact on emotion recognition ability (e.g. autism spectrum disorder, Harwood et al., 1999; Maurer & Newbrough, 1987; McAlpine et al., 1991; McAlpine et al., 1992; McKenzie et al., 2001; Leung & Singh, 1998). One study explicitly stated that a diagnosis of autism spectrum disorder was an exclusion criterion (Owen et al., 2001) and another made reference to exclusion criteria that included 'no concurrent secondary diagnosis' (Weisman & Brosgole, 1994). The study by Rojahn et al. (1995) had clearly defined exclusion criteria that addressed key variables known to have a potential impact on emotion recognition ability.

### 3.1.5 Control Group(s)

The nine selected studies recruited a total of 424 participants into control/comparison groups. Three studies recruited a comparison group that comprised adult participants, four studies recruited a comparison group comprising of child participants and two studies recruited both adult and child comparison groups.

One hundred and seventy control participants were reported to be male (51%) and 162 (49%) were reported to be female. One study (McAlpine et al., 1992) did not provide any information about the sex of the participants in the comparison group and one study simply stated that their adult comparison group were 'matched' with the experimental group (Harwood et al., 1999).

The reported age range of child participants was 3 – 15 years. The reported age range of participants in the adult comparison groups was 21 – 61 years. One study reported only the mean age and standard deviation of participants in the adult comparison group (36 years, SD 8.6, Owen et al., 2001). One study did not report any data regarding the age of the participants in the adult control group (Rojahn et al., 1995) and one study stated that the adult control group was ‘matched’ with the learning disability group, but did not give any specific detail (Harwood et al., 1999).

## **3.2 Measures**

### *3.2.3 Emotion recognition task materials*

Most of the selected studies primarily used photograph-based images of human faces. Four of the nine selected studies selected images from a set of original photographs devised by Ekman and Friesen (1975, 1976; McAlpine et al., 1991; McAlpine et al., 1992; Owen et al., 2001; Leung & Singh, 1998). In addition to using the photographic materials devised by Ekman and Friesen (1976), the study by Owen et al. (2001) also used a set of twelve emotional stories adapted from materials used by previous authors in a study of children with a learning disability (Stewart & Singh, 1995). The study by Rojahn et al. (1995) used a set of experimental tasks called the ‘Facial Discrimination Task’. The emotion recognition measure comprised 40 black and white photographs of faces and had mean retest reliability of 0.79 (Rojahn, Kroeger & McElwain, 1994).

The studies that used the Ekman and Friesen (1976) photographic stimuli and the Rojahn et al. (1995) study were assigned a rating of well-covered for the associated quality criterion.

Harwood et al. (1999) used photographic emotion recognition materials that were originally developed and used in a study by Mazurski and Bond (1993). These materials were coloured photographs of both adults and children and the photographs used were those with the highest inter-rater agreement regarding what the emotion

shown in the photograph was (92% - 100% agreement among a sample of 468 University students).

Maurer and Newbrough (1987) used photographic images of children with and without a learning disability displaying different emotions. The set of images of children without a learning disability were used in two previous studies (Felleman, Barden, Carlson, Rosenberg & Masters, 1983; Masters, Barden & Ford, 1979). The set of images of the children with a learning disability were created specifically for the study. Two hundred slides of children with a learning disability displaying spontaneous expressions and 200 slides of posed expressions were produced and shown to 50 'adult judges'. A 75% level of agreement among the 50 judges made a slide eligible for inclusion in the study.

The study by McKenzie et al. (2001) also used photographic images of adults and children displaying various emotions, both with and without context. These images were obtained from 'Color Cards: Emotions' (1996) and 'Color Cards: Sequencing Social Situations' (1991). McKenzie et al. (2001) also used line drawing stimuli of faces depicting different emotions.

In contrast with the other selected studies, all of which employed photographic based images of human faces, Weisman and Brosigole (1994) used cartoon drawings of a bird, chipmunk and a dog displaying various emotions. The cartoon images had been used in previous studies with children with and without learning disability, but no psychometric data was available. This study was therefore judged to poorly address the criterion related to the emotion recognition measures used.

### *3.2.3 Emotion categories*

The included studies varied in terms of the type and range of emotions evaluated. The four studies that used selected photographs from the original set developed and validated by Ekman and Friesen (1975) included images that showed each of the six basic emotions: happiness, sadness, anger, disgust, fear and surprise (McAlpine et al., 1991; McAlpine et al., 1992; Owen et al., 2001; Leung & Singh, 1998). The

study by Harwood et al. (1999) also included photographs depicting these six emotions. McKenzie et al. (2001) also evaluated emotion recognition of six different emotion categories: happiness, sadness, anger, fear, boredom and worry.

Two studies examined recognition of four emotion categories: happiness, sadness, anger and neutrality (Maurer & Newbrough, 1987; Weisman & Brosgole, 1994). The study by Rojahn et al. (1995) included only images of happy and sad expressions, in addition to images depicting a neutral expression. The study by Owen et al. (2001) also included tasks that required participants to classify emotion images along two different dimensions: pleasant - unpleasant and arousing - un-arousing.

#### *3.2.4 Emotion recognition task paradigms*

A variety of different task paradigms were used in the studies selected for inclusion and some studies used more than one task paradigm and different experimental procedures.

Identification tasks were most commonly used. These tasks required participants to choose the image that showed a target emotion, from a choice of six images (e.g. McAlpine et al., 1991; McAlpine et al., 1992; McKenzie et al., 2001; Leung & Singh, 1998), from a choice of three images (Weisman & Brosgole, 1994) or from a choice of two images (McKenzie et al., 2001). Other studies used tasks that required participants to name the emotion shown, from a prescribed number of options (e.g. Harwood et al., 1999; Maurer & Newbrough, 1987; Owen et al., 2001; Rojahn, et al., 1995) and some used matching tasks, where participants were shown an image depicting a specific emotion and were asked to find another image that displayed the same emotion (Harwood et al., 1999).

#### *3.2.5 Control Task(s)*

Only two of the selected studies included a control task (Rojahn et al., 1995; Harwood et al., 1999). Rojahn et al. (1995) used a control task as part of the 'Facial Discrimination Task' battery that comprised 40 black and white photographs of faces. Participants were asked to make a judgement about the age of the person in

each photograph ('old' vs. 'young') and then to make a further judgement about whether the person was 'a little' old/young or 'a lot' old/young. Harwood et al. (1999) used a control task as a means of ensuring that any differences on the emotion tasks were not a result of task complexity or an inability to match items. The control task was matched with the emotion task in that both involved selection and/or matching images from a selection of six choices and also involved human faces. Participants were presented with six adults faces simultaneously and were then shown six identical photographs one at a time and were asked to match each face with the corresponding face, from the choice of six. Only those participants who scored 100% on the matching task were subsequently administered the emotion recognition tasks.

### **3.3 Statistical Analyses**

With respect to the statistical analyses relevant to the present systematic review, all of the studies, with one exception (McAlpine et al., 1991), used analysis of variance (ANOVA). Some studies also carried out t-tests (Maurer & Newbrough, 1987; McKenzie et al., 2001; Owen et al., 2001). One study simply reported percentage correct scores for recognition of each emotion for the different participant groups (McAlpine et al., 1991). There was some variability in the detail of reporting of statistical analyses between the studies. None of the studies reported a power calculation that was used in order to pre-determine sample size.

### **3.4 Key findings of selected studies**

All of the studies found that the adult participants with a learning disability displayed relative impairment on some, or all of the emotion recognition tasks administered, when compared with either adults or children without a learning disability, or with both. However, not all studies evaluated their findings statistically (Maurer & Newbrough, 1987; McAlpine et al., 1991).

#### *3.4.1 Null results*

Some studies found no significant difference between adults with a learning disability and participants without a learning disability on specific emotion

recognition tasks. Weisman and Brosgole (1994) found that participants with a learning disability performed less well than a group of child control participants on specific emotion recognition tasks that involved reading emotion-based vignettes. However, there were no significant differences between subgroups of participants with mild learning disability, moderate learning disability and the control group when a basic recognition task was administered (pointing to happy, sad or angry faces).

Owen et al. (2001) found no significant difference between the two adult groups (learning disability and control group) when participants were asked to rate the valence of an emotion (i.e. pleasant - unpleasant). In the same study, although the learning disability group had lower mean scores on a story task in which participants were required to identify a photograph that showed the related emotion, the difference between the two groups only approached significance ( $p < 0.059$ ).

#### *3.4.2 Age*

One study reported a significant relationship between age and emotion recognition task scores. McKenzie et al. (2001) found a significant, negative relationship between age and total score on emotion recognition tasks that involved labelling emotions, identifying from a choice of six and identifying from a choice of two for participants with a learning disability. A similar, positive relationship was found for participants in a child control group, on the same tasks. Conversely, one study reported no significant correlation between age and emotion recognition task scores for both the learning disability and child control group (Leung & Singh, 1998). No other studies reported any analyses of any relationship between age and emotion recognition task scores.

#### *3.4.3 IQ*

Five studies examined a potential relationship between IQ scores and emotion recognition task performance for participants with learning disability. Some studies reported poorer emotion recognition ability with decreasing IQ scores (McAlpine et al., 1991; McAlpine et al., 1992; McKenzie et al., 2001), although this was not tested

statistically in one study (McAlpine et al., 1991). Weisman and Brosgole (1994) also found that IQ was negatively related to emotion recognition task score, but only for vignette-based emotion tasks. Leung and Singh (1998) reported no significant correlation between IQ and emotion recognition scores for participants with a learning disability.

#### *3.4.4 Specific emotions*

Six studies reported data regarding recognition scores for different emotions, specifically. Owen et al. (2001) found that the learning disability group were particularly impaired in recognising disgust, compared with other basic emotions. Maurer and Newbrough (1987) found that the learning disability group were significantly less accurate at identifying happiness, neutrality and anger than a control group, but that no significant difference was found for sadness. Leung and Singh (1998) found that the learning disability group had significant difficulty identifying sadness, anger, fear, disgust and surprise when compared to a child control group. Post-hoc error analyses, carried out by Rojahn et al. (1995) suggested that neutral expressions were the most difficult to rate, for the learning disability group, compared with happiness and sadness. McAlpine et al. (1991) did not compare the relative ability of people with a learning disability to recognise specific emotions statistically, but reported the proportion of occasions on which each group correctly identified each specific emotion. This suggested that the learning disability group were relatively impaired in recognising disgust, anger, sadness, surprise and fear.

#### *3.4.5 Effect Sizes*

None of the studies provided effect sizes for any significant findings. Therefore, where possible, effect sizes for relevant statistically significant findings in each study were calculated using Cohen's  $d$  (mean 1 – mean 2/pooled standard deviation). Effect sizes were calculated for studies ( $n = 4$ ) that provided an overall mean score and standard deviation (including those that reported mean % scores) on the emotion recognition task(s) for the learning disability and control group(s). The study by Weisman and Brosgole (1994) provided mean percentage error scores but did not

give any information regarding standard deviation of these scores. Leung and Singh (1998) and Maurer and Newbrough (1987) analysed data according to the percentage correct responses given for each emotion (happy, sad etc.) and did not provide standard deviations for these scores. The studies by McAlpine et al. (1991) and McAlpine et al. (1992) also reported results in relation to the number of correct scores for each emotion item, by group, but did similarly not provide information regarding standard deviation. Thus, effect sizes could not be calculated for these five studies. Effect sizes were calculated for significant results in the remaining four studies and are reported in Table 3.

Table 3. Effect sizes for analyses of emotion recognition task performance.

Study	Data used to calculate effect size	Control Group	Effect size (Cohen's <i>d</i> )	Descriptor
<b>Rojahn et al. (1995)</b>	Mean overall scores on emotion task	Adult and Child	-1.28 (LD vs. Adult control group) -0.13 (LD vs. Child control group)	Large Small
<b>Owen et al. (2001)</b>	Mean scores on: (i) recognition of emotion task (emotion categories) (ii) recognition of emotion task (emotion dimensions) (iii) recognition of emotion in stories (emotion dimensions)	Adult	(i) -1.61 (ii) -2.44 (iii) -2.40	Large Large Large
<b>Harwood et al. (1999)</b>	Mean percentage correct identification scores for photographic display emotion stimuli	Adult	-3.34	Large
<b>McKenzie et al. (2001)</b>	Mean scores on:  <u>1. Line Drawings Tasks:</u> (i) labelling, (ii) choice from 6 (iii) choice from 2  <u>2. Photos without context tasks:</u> (i) labelling, (ii) choice from 6 (iii) choice from 2  <u>3. Photos with context tasks</u> (i) labelling (ii) choice from 6 (iii) choice from 2	Child	1(i) - 1.56 1(ii) - 1.56 1(iii) - 1.31  2(i) - 0.91 2(ii) - 0.90 2(iii) - 0.84  3(i) - 1.35 3(ii) - 1.41 3(iii) - 1.02	Large Large Large  Large Large Large  Large Large Large

## **4. Discussion**

### **4.1 Main findings and comparison with extant literature**

This systematic review examined the relative ability of adults with learning disability to recognise facial expressions of emotion, compared with the non-learning disabled population. Overall, the results suggest that adults with a learning disability do demonstrate relative impairment in this ability. For those studies for which effect sizes could be calculated, these generally revealed a large effect size for most significant results. Unfortunately, effect sizes could only be calculated for less than 50% of the selected papers, and the papers for which this was possible tended to be the papers that had smaller sample sizes and were underpowered. Despite the fact that the majority of studies reviewed found consistent evidence to suggest impaired emotion recognition is common to adults with a learning disability, the results should be interpreted with a degree of caution, due to the poor methodological strength of many of the included studies. Furthermore, it is difficult to draw any conclusions regarding the causes of any emotion recognition deficits in this population, due to the variety of methodologies employed by studies. That is, the included studies used different comparison populations (either chronological or mental age matched participants) and used different emotion recognition tasks, with varying degrees of validity and reliability. To date, there has not been any previous systematic review of the evidence in this area, and more recent studies have seen a shift towards attempting to determine both the likely cause and the potential long-term effects of impaired emotion recognition in people with learning disability. It was therefore felt important to first review existing evidence in order to confirm the very presence of this impairment in adults with a learning disability.

A key methodological limitation of many of the included studies was a failure to include, or at least to report the inclusion of, detailed exclusion and inclusion criteria for the experimental groups. Therefore, for a significant proportion of included studies, it is unclear whether participants in the learning disability groups may have had comorbid diagnoses that are known to have a significant, detrimental impact on the ability to recognise emotions. These diagnoses include syndromes related to

learning disability, such as autism spectrum disorder and Down syndrome, in addition to diagnoses linked to mental health difficulties, including schizophrenia, major depressive disorder and dementia (e.g. Fernandez-Duque & Black, 2005; Harms et al., 2010; Kohler, Bilker, Hagendoom, Gur & Gur, 2000; Wishart, 2007).

Moreover, only some of the studies used emotion recognition materials with well-tested and established psychometric properties. The *Pictures of Facial Affect*, developed by Ekman (1975) and Ekman and Friesen (1976) were used in several studies and have demonstrated high levels of reliability and validity. The Facial Discrimination Task used by Rojahn et al. (1995) was also well-tested, with acceptable psychometric properties. However, other studies used a variety of different materials that have been less thoroughly evaluated. Moreover, no studies reported having examined the criterion validity of the emotion recognition materials used. Rojahn, Lederer and Tassé (1995), in their review, highlight the importance of such evaluations in terms of establishing the ecological validity of laboratory-based emotion recognition measures.

Not all previous studies in this area made an attempt to recruit any control group against which the performance of the learning disability group could be compared. Therefore, that the selected studies included either a control group of children ('mental age matched') or adults ('chronological age matched') gives them a methodological advantage over several other studies in this area (e.g. Gray et al., 1983; Walz & Benson, 1996). The results of the selected studies can therefore be viewed as more reliable than those of studies that fail to include developmentally-normal comparison groups.

The current review did not find any consistent evidence to provide support to neither the emotion specificity hypothesis (Rojahn et al., 1995), nor to the proposal that emotion recognition deficits in people with learning disability can be fully accounted for by cognitive-intellectual limitations (Moore, 2001). Although some studies that compared the impact of intellectual impairment on emotion recognition task performance reported that participants with higher IQ scores (i.e. those whose level

of ability fell within the ‘mild’ range of learning disability) performed better on emotion recognition tasks than those with lower IQ scores (i.e. ‘moderate learning disability, McAlpine et al., 1991; McAlpine et al., 1992; McKenzie et al., 2001), others found no significant relationship between the two (Leung & Singh, 1998). Thus, there is mixed evidence regarding the proposal that cognitive-intellectual impairment might account for the observed emotion recognition deficits. Other than the study by Rojahn et al. (1995), none of the selected studies included both a mental age matched control group of children in addition to a control task. Inclusion of a control task is key to demonstrating that people with a learning disability are not impaired at processing information that has no emotion recognition component, compared with mental age matched controls (Moore, 2001). Therefore, the studies included in this review that do not include any control task cannot provide any insight into the proposed ‘emotion specificity hypothesis as they are unable to directly compare performance on affective vs. non-affective tasks. Furthermore, the study by Rojahn et al. (1995) only evaluated response to happy, sad and neutral emotional expressions and therefore may not provide a comprehensive assessment of participants ability across the full spectrum of emotions. Thus, replication of the findings of the study by Rojahn et al. (1995) and further evaluation of the emotion specificity hypothesis is still pending (Zaja & Rojahn, 2008).

#### **4.2 Strengths of review**

Previous reviews in this area have included studies of both adults and children with learning disability (Moore, 2001; Rojahn et al., 1995). There is some evidence to suggest that children following a typical development trajectory may demonstrate improvement in emotion recognition capabilities throughout childhood and adolescence (e.g. Thomas et al., 2007). If this pattern is also present in children with a learning disability, this may confound the results of studies that include mixed experimental groups of both adults and children. Therefore, the inclusion of only studies evaluating the ability of *adults* with a learning disability to recognise emotions in the present review potentially allows more definitive conclusions about the presence of any impairment in this population to be drawn.

Additionally, the previous reviews by Rojahn et al. (1995) and Moore (2001) did not include a tool with which to appraise the quality of the literature selected for inclusion. A comprehensive search strategy was used for the present review and the use of a quality assessment tool was a relative strength that allowed for a more transparent comparison of, and focus upon, the methodological strength of selected studies.

### **4.3 Limitations of review**

The present systematic review had a specific focus: to evaluate the impact of learning disability on the ability of adults to recognise facial expressions of emotion. This focus was selected following consideration of the known difficulties with social functioning frequently experienced by this population and the methodological variability of studies in this area. Only studies that included some form of comparison group were included in the present review and this resulted in the exclusion of some potentially relevant studies. However, given that studies in this area vary in terms of the emotion recognition measures used, it was felt that it would be difficult to accurately determine whether there was a relative impairment in the performance of the experimental group, if the study did not include any comparison group.

It is recommended that a second researcher is involved in the data extraction and/or quality appraisal process in order to enhance reliability and reduce bias (CRD, 2009). However, this was not possible for the current review and must be considered a limitation.

### **4.4 Implications for future research**

The present review provides evidence to indicate that adults with a learning disability are relatively impaired in their ability to recognise facial expressions of emotion. However, in order to establish the extent of this impairment and to begin to evaluate the potential reasons for which this impairment may exist, more methodologically sound studies are required. In practice, this should involve inclusion of both chronological and mental age matched control participants and adoption of strict

inclusion and exclusion criteria in order to minimise the potential impact of these known, confounding variables on performance on emotion recognition tasks.

A further consideration for future research in this field lies in the selection of emotion recognition task materials and paradigms. The ecological validity of the materials used should be considered, and the use of schematic drawings of faces or cartoon pictures of non-human faces is not recommended (Moore, 2001). Most task paradigms used in studies to date have involved showing images of a face in isolation. Given that preliminary data exists to suggest that additional contextual information may enhance the ability of people with a learning disability to accurately recognise emotions, it may be appropriate to include both contextualised and non-contextualised stimuli in future studies in order to further evaluate the potentially mediating role of context in emotion recognition in this group of people (e.g. McKenzie et al., 2001).

#### **4.5 Clinical implications**

Given that the findings of the reviewed studies generally suggest that adults with learning disability have difficulty with recognising and interpreting facial emotions, it is important to give due consideration to the potential clinical implications of this. Studies in this area, to date, have reported mixed results, with some finding evidence to suggest that impaired emotion recognition in this group may be linked to aggressive behaviours. Therefore, the role of emotion recognition ‘training’ programmes in terms of improving this ability and potentially reducing later antisocial behaviour warrant further evaluation. Future studies in this area should pay due attention to the methodological recommendations described above, particularly in terms of inclusion/exclusion criteria, use of appropriate comparisons groups and careful consideration of the emotion recognition measures employed in order to enhance the ecological validity of any findings.

## **4.6 Conclusions**

The current systematic review provides evidence to suggest that adults with learning disability are relatively impaired in facial emotion recognition, when compared with either adults or children from the general, non-learning disabled population. Methodological factors associated with the included studies do not allow any firm conclusions regarding the cause of these impairments to be made. Future research should seek to address the methodological limitations described above in order to attempt to further examine the potential cause of emotion recognition impairments, to establish the long-term impact of impaired emotion recognition in adults with learning disability and, in turn, to allow for tailored emotion recognition programmes to be devised and evaluated.

## 5. References

- Brosigole, L., Gioia, J. & Zingmond, R. (1986). Facial- and postural-affect recognition in the mentally handicapped and normal young children. *International Journal of Neuroscience*, 30, 127-144.
- Centre for Reviews and Dissemination (2009). *Systematic reviews: CRD's guidance for undertaking reviews in healthcare*. York: CRD, University of York.
- Edwards, E., Jackson, H.J. & Pattison, P.E. (2002). Emotion recognition via facial expression and affective prosody in schizophrenia: a methodological review. *Clinical Psychology Review*, 22(6), 789-832.
- Ekman, P. & Friesen, W.V. (1975). *Unmasking the face: a guide to recognising emotion from facial cues*. Englewood Cliffs, NJ: Prentice Hall
- Ekman, P. & Friesen, W.V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.
- Felleman, E.S., Barden R.C., Carlson, C.R., Rosenberg, L. & Masters, J.C. (1983). Children's and adults recognition of spontaneous and posed emotional expressions in young children. *Developmental Psychology*, 19, 405-413
- Fernandez-Duque, F. & Black, S.E. (2005). Impaired recognition of negative facial emotions in patients with frontotemporal dementia. *Neuropsychologia*, 43(11), 1673-1687.
- Garcia-Villamizar, D., Rojahn, J., Zaja, R. H., & Jodra, M. (2010). Facial emotion processing and social adaptation in adults with and without autism spectrum disorder. *Research in Autism Spectrum Disorders*, 4(4), 755-762.

- Gioia, J.V. & Brosgole, L. (1988). Visual and auditory affect recognition in singly diagnosed mentally retarded patients, mentally retarded patients with autism and normal young children. *International Journal of Neuroscience*, 43, 149-163.
- Gray, J.M., Fraser, W.L. & Leudar, I. (1983). Recognition of emotion from facial expression in mental handicap. *British Journal of Psychiatry*, 142, 566-571.
- Harms, M.B., Martin, A. & Wallace, G.L. (2010). Facial emotion recognition in autism spectrum disorders: a review of behavioral and neuroimaging studies. *Neuropsychology Review*, 20, 290-322.
- Harwood, N. K., Hall, L. J., & Shinkfield, A. J. (May 1999). Recognition of facial emotional expressions from moving and static displays by individuals with mental retardation. *American Journal on Mental Retardation*, 104(3), 270-278.
- Jahoda, A., Pert, C., & Trower, P. (2006). Frequent aggression and attribution of hostile intent in people with mild to moderate intellectual disabilities: An empirical investigation. *American Journal of Mental Retardation*, 111(2), 90-99.
- Jahoda, A., Pert, C., & Trower, P. (Mar 2006). Socioemotional understanding and frequent aggression in people with mild to moderate intellectual disabilities. *American Journal on Mental Retardation*, 111(2), 77-89.
- Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child*, 2, 217-250.
- Kasari, C., Freeman, S.F.N. & Hughes, M.A. (2001). Emotion recognition by children with Down syndrome. *American Journal on Mental Retardation*, 106, 50-72.

- Kohler, C.G., Bilker, W., Hagendoorn, M., Gur, R.E. & Gur, R.C. (2000). Emotion recognition deficit in schizophrenia: association with symptomatology and cognition. *Biological Psychiatry*, 48(2), 127-136.
- Leppänen, J.M. (2006). Emotional information processing in mood disorders: a review of behavioural and neuroimaging findings. *Current Opinion in Psychiatry*, 19(1), 34-39.
- Leung, J. P., & Singh, N. N. (Apr 1998). Recognition of facial expressions of emotion by Chinese adults with mental retardation. *Behavior Modification*, 22(2), 205-216.
- Levy, L.H., Orr, T.B. & Rosenzweig, S. (1960). Judgements of emotion from facial expression by college students, mental retardates and mental hospital patients. *Journal of Personality*, 28, 342-249.
- Masters, J.C., Barden, R.C. & Ford, M.E. (1979). Affective states, expressive behaviour and learning in children *Journal of Personality and Social Learning*, 33, 380-390.
- Matheson, E., & Jahoda, A. (Jan 2005). Emotional understanding in aggressive and nonaggressive individuals with mild or moderate mental retardation. *American Journal on Mental Retardation*, 110(1), 57-67.
- Maurer, H., & Newbrough, J. R. (Mar 1987). Facial expressions of mentally retarded and nonretarded children: I. recognition by mentally retarded and nonretarded adults. *American Journal of Mental Deficiency*, 91(5), 505-510.
- Mazurski, E.J. & Bond, N.W. (1993). A new series of slides depicting facial expressions of affect: a comparison with the pictures of facial affect series. *Australian Journal of Psychology*, 45, 41-47.

- McAlpine, C., Kendall, K. A., & Singh, N. N. (Jul 1991). Recognition of facial expressions of emotion by persons with mental retardation. *American Journal on Mental Retardation*, 96(1), 29-36.
- McAlpine, C., Singh, N. N., Ellis, C. R., Kendall, K. A., & Hampton, C. (Oct 1992). Enhancing the ability of adults with mental retardation to recognize facial expressions of emotion. *Behavior Modification*, 16(4), 559-573.
- McAlpine, C., Singh, N. N., Kendall, K. A., & Ellis, C. R. (Oct 1992). Recognition of facial expressions of emotion by persons with mental retardation: A matched comparison study. *Behavior Modification*, 16(4), 543-558.
- McKenzie, K., Matheson, E., McKaskie, K., Hamilton, L. & Murray, G.C. (2001). A picture of happiness. *Learning Disability Practice*, 4(1), 26-29.
- Moffatt, C.W., Hanley-Maxwell, C. & Donnellan, A.M. (1995). Discrimination of emotion, affective perspective-taking and empathy in individuals with mental retardation. *Education & Training in Mental Retardation & Developmental Disabilities*, 30(1), 76-85.
- Moore, D. G. (2001). Reassessing emotion recognition performance in people with mental retardation: A review. *American Journal on Mental Retardation*, 106(6), 481-502.
- Moher, D., Liberati, A., Tetzlaff, J. & Altman, D.G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(6). Retrieved 26<sup>th</sup> August 2014 from:  
[plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000097](http://plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000097)
- Owen, A., Browning, M. & Jones, R.S.P. (2001). Emotion recognition in adults with mild-moderate learning disabilities: an exploratory study. *Journal of Intellectual Disabilities*, 5, 267-280.

- Plesa-Skwerer, D., Faja, S., Schofield, C. (2006). Perceiving facial and vocal expressions of emotion in individuals with Williams syndrome. *American Journal on Mental Retardation*, (99), 477-486.
- Rojahn, J., Kroeger T.L & McElwain, D.C. (1994). Performance on the Penn Facial Discrimination Task by adults with mental retardation. *American Journal on Mental Retardation* 99, 316-319.
- Rojahn, J., Lederer, M., & Tassé, M. J. (1995). Facial emotion recognition by persons with mental retardation: A review of the experimental literature. *Research in Developmental Disabilities*, 16(5), 393-414.
- Rojahn, J., Rabold, D. E., & Schneider, F. (1995). Emotion specificity in mental retardation. *American Journal of Mental Retardation*, 99(5), 477-486.
- Rojahn, J., & Warren, V. J. (Dec 1997). Emotion recognition as a function of social competence and depressed mood in individuals with intellectual disability. *Journal of Intellectual Disability Research*, 41(6), 469-475.
- Rump, K.M., Giovanelli, J.L., Minchew, N.J. & Strauss, M.S. (2009). The development of emotion recognition in individuals with autism. *Child Development*, 80(5), 1434-1447.
- Scottish Intercollegiate Guidelines Network – Annex C. Retrieved 26<sup>th</sup> August 2014 from: [www. Sign.ac.uk/guidelines/fulltext/50/annexc.html](http://www.Sign.ac.uk/guidelines/fulltext/50/annexc.html)
- Simon, E. W., Rosen, M., & Ponpipom, A. (Sep-Oct 1996). Age and IQ as predictors of emotion identification in adults with mental retardation. *Research in Developmental Disabilities*, 17(5), 383-389.

- Stewart, C. A. & Singh, N.N. (1995). Enhancing the recognition and production of facial expressions of emotion by children with mental retardation. *Research in Developmental Disabilities*, 16, 365–382.
- Tager-Flusberg, H. (1999). A psychological approach to understanding the social and language impairments in autism. *International Review of Psychiatry*, 11(4), 325-334.
- Thomas, L.A., De Bellis, M.D., Graham, R. & LaBar, K.S. (2007). Development of emotional facial recognition in late childhood and adolescence. *Developmental Science*, 10(5), 547-558.
- Vicari, S., Reilly, J.S., Pasqualetti, P., Vizzotto, A. & Caltagirone, C. (2000). Recognition of facial expressions of emotions in school-age children: the intersection of perceptual and semantic categories. *Acta Paediatrica*, 89(7), 836 – 845.
- Walz, N., C., & Benson, B., A. (1996). Labeling and discrimination of facial expressions by aggressive and nonaggressive men with mental retardation. *American Journal on Mental Retardation*, 101(3), 282-291.
- Warren, V.J. (1992). Recognition of facial expressions of emotion by persons with mental retardation and symptoms of depression. *Unpublished doctoral dissertation*, The Ohio State University, Columbus.
- Weisman, J., & Brosgole, L. (Mar 1994). Facial affect recognition in singly diagnosed mentally retarded people and normal young children: A methodological comparison. *International Journal of Neuroscience*, 75(1-2), 45-55.
- Wishart, J.G. (2007). Socio-cognitive understanding: a strength or weakness in Down's syndrome? *Journal of Intellectual Disability Research*, 51, 996-1005.

Wishart, J.G., Cebula, K.R., Willis, D.D., Pitcairn, T.K. (2007). Understanding of facial expressions of emotion by children with intellectual disabilities of varying aetiology. *Journal of Intellectual Disability Research*, 51, 551-563.

Woodcock, K. A., & Rose, J. (May 2007). The relationship between the recognition of facial expressions and self-reported anger in people with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*, 20(3), 279-284.

Xeromeritou, A. (Sep 1992). The ability to encode facial and emotional expressions by educable mentally retarded and nonretarded children. *The Journal of Psychology: Interdisciplinary and Applied*, 126(5), 571-584.

Zaja, R. H., & Rojahn, J. (2008). Facial emotion recognition in intellectual disabilities. *Current Opinion in Psychiatry*, 21(5), 441-444.

## **Journal Article 2: Primary Empirical Study**

Title

**Recognition of facial expressions of emotion by adults with intellectual disability: is there evidence for the emotion specificity hypothesis?**

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Conflict of Interest Declaration

The corresponding author conducted this research as part of a portfolio thesis for a Doctorate in Clinical Psychology at the University of Edinburgh. This training place was jointly funded by NHS Education for Scotland and NHS Lothian. No other sponsorship or funding was received.

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<sup>1</sup> Tables are inserted into the text for ease of reading but would be presented separately for submission, and formatting amended to meet submission requirements. 1.5 line spacing has been used to provide consistency throughout the thesis but would be amended prior to submission to satisfy formatting requirements. Appendices are labelled to ensure consistency throughout the thesis.

## **Abstract**

### **Objectives**

This study aimed to evaluate the emotion recognition abilities of adults with intellectual disability. Specifically, evidence for the emotion specificity hypothesis was examined, (Rojahn et al., 1995) and the impact of task paradigm and stimulus type on recognition accuracy was evaluated.

### **Methods**

Adults with an intellectual disability and adults and children without intellectual disability completed facial emotion recognition and control tasks. Three sets of materials were used: line drawings, photographs without contextual information and photographs with context. Each set of pictures comprised three separate tasks: a naming task, recognition from a choice of nine and from a choice of two.

### **Results**

The intellectual disability group had significantly lower mean overall scores on the emotion recognition tasks and control tasks than both control groups ( $P < 0.001$  and  $P = 0.001$ , respectively). The availability of contextual information improved emotion recognition for the intellectual disability group, when compared with line drawing stimuli ( $P = 0.034$ ). Identifying a target emotion from a choice of two was relatively easier for the intellectual disability group ( $P < 0.001$ ).

### **Conclusions**

Adults with an intellectual disability demonstrated relative impairment in recognising facial expressions of emotion compared with both adult and child control groups. This relative impairment was also evident on control tasks. Therefore, the study does not provide any evidence to support the emotion specificity hypothesis. However, further exploration of the hypothesis, using control tasks with established levels of difficulty, is warranted.

**Keywords**

Emotion recognition; Intellectual disability; Emotion specificity hypothesis; Facial recognition

## Introduction

The ability to recognise, label and interpret expression of emotion in others is a fundamental skill that is considered to be a key component of successful social interactions and relationships (Hext & Lunskey, 1997). Facial expression has been identified as one of the most important ways in which emotions are communicated and expressed to others (Ekman et al., 1972). It is generally accepted that people with learning disabilities have difficulties in recognising and identifying facial expressions of emotions. Early studies in this area that compared adults with and without intellectual disability found initial evidence to suggest that adults with an intellectual disability were significantly less accurate in recognising four facial expressions of emotion (Maurer & Newbrough, 1987). Subsequently, McAlpine et al. (1991) found that a large group of both adults and children with an intellectual disability performed less well on tasks of facial emotion recognition than their non-intellectually impaired counterparts. A number of other further studies subsequently found further evidence to support the proposal that people with an intellectual disability are less adept at recognising facial expressions of emotion than their non-disabled counterparts (e.g. Owen et al, 2001; Rojahn et al., 1995; Weisman & Brosgole, 1994).

Several studies have found evidence to suggest that the ability to decode emotional expression of others plays a fundamental role in the development of socio-emotional competence (e.g. Hooker & Park, 2002; Leppänen & Hietanen, 2001). It therefore follows that emotion recognition deficits are likely to lead to socio-emotional vulnerabilities. There is evidence to suggest that poor social competence is related to many of the problems people with intellectual disability are reported to experience, perhaps to a greater extent than cognitive limitations (Rojahn, Lederer & Tassé, 1995). For example, poor social skills were reported to be the cause of failure of placements within the community and the ability to maintain employment for people with intellectual disability (e.g. Best-Sigford et al., 1982; Martin et al., 1986). Moreover, in a cross-sectional study, Bandura (1986) found that individuals who had poorer emotion recognition skills tended to be viewed more negatively than those

with superior emotion recognition capabilities. More recently, some studies have found preliminary evidence that suggested difficulties with emotion recognition in people with learning disabilities may be linked to aggressive behaviour (Matheson & Jahoda, 2005). Rojahn et al. (1995) highlighted that the socio-emotional vulnerabilities associated with impaired emotion recognition skills could potentially result in an increased risk for mental illness in people with intellectual disability. They proposed that this could explain the increased incidence of severe emotional problems within the population of people with intellectual disability (e.g. Bouras & Drummond, 1992; Reiss & Rojahn, 1993). Therefore, given the potential, detrimental impact of emotion recognition deficits that likely result in impaired socio-emotional competence in people with an intellectual disability, research into the possible causes of this impairment is important in order to allow for effective, targeted interventions that aim to improve this fundamental skill with this group of people.

### **Competing theories**

There are two main, competing proposals that attempt to explain why people with an intellectual disability are impaired in recognising facial expressions of emotion. The first proposal is that impaired performance on emotion recognition tasks is a reflection of a *specific* impairment in emotion-perception competence (emotion specificity hypothesis, Rojahn et al., 1995). The second proposal is that basic emotion perception is intact in people with an intellectual disability and, instead, that poor performance on emotion recognition tasks is a consequence of poor IQ-related information processing abilities (Moore, 2001). These two competing theories are discussed in turn, as follows.

The emotion specificity hypothesis states that the cognitive-intellectual deficit in people with intellectual disability alone cannot fully explain the facial emotion recognition deficits observed in this group. Evidence for this hypothesis comes primarily from a study by Rojahn et al., (1995). These authors compared the performance of a group of adults with intellectual disability with that of a group of 'mental age matched' children and a group of adults without any disability on an emotion recognition task and a control task, with equivalent task demands (age

estimation). They found that the group of adults with an intellectual disability were significantly impaired in recognising emotions (happy, sad and neutral expressions); in comparison with the group of mental age matched controls and that this impairment was not evident on a control task. Rojahn et al. (1995) concluded that their study provided credible evidence for the emotion-specificity hypothesis: that people with an intellectual disability have a *specific* impairment in recognising facially expressed emotions, which cannot be accounted for by their cognitive limitations. There are a number of methodological strengths associated with the study by Rojahn et al. (1995), in comparison with other studies in this area, most notably they recruited both adult and child control groups, included a control task and used validated emotion recognition materials. However, the materials used were black and white photographs of faces and may therefore have lacked ecological validity. Additionally, Moore (2001) highlighted that, closer examination of the results revealed that the group of people with an intellectual disability did not differ from the mental age matched control group in terms of their ability to rate happy and sad faces. Rather, the group differences were determined by their ability to rate neutral expressions. Moore (2001) therefore highlighted that the only *specific* emotion recognition deficit observed in the study was in terms of rating faces with no emotional content (i.e. neutral expressions). It is possible that rating neutrality was particularly difficult for people with an intellectual disability. They might have believed that their primary task was to determine whether faces were happy or sad and may have lacked confidence in their ability to rate ambiguous stimuli (Moore, 2001). Therefore, there may exist an alternative explanation for the findings of the study by Rojahn et al. (1995) that could question the validity of the emotion specificity hypothesis.

It is proposed, however, that some other studies provided indirect evidence to support the emotion specificity hypothesis (e.g. Wishart et al., 2007; Williams et al., 2005). These studies found evidence to suggest that groups of people with Down syndrome, Fragile X syndrome and unclassified intellectual disability performed less well on emotion recognition tasks than on control tasks with no emotion recognition component, compared with a typically developing group of participants. However,

these studies did not test the hypothesis statistically and therefore do not provide strong empirical support.

Zaja and Rojahn (2008) highlighted the methodological considerations pertinent to any ‘credible’ emotion specificity hypothesis study: at least two groups of participants (individuals with an intellectual disability and ‘mental age-matched’, typically developing children) and two tasks of comparable complexity (i.e. one task of facial affect discrimination and one task that requires discrimination based on other facial cues). To date, no studies have attempted to replicate the study by Rojahn et al. (1995) and therefore further research in this area is warranted.

In contrast to the emotion-specificity hypothesis, Moore (2001) proposed that emotion-perception capacities in people with intellectual disability are intact and, that poor IQ-related *information processing* ability may account for the observed impairments in emotion recognition. In support of this proposal, in a review, Moore (2001) highlighted a number of studies in which no significant differences between the emotion recognition capabilities of adults with an intellectual disability and mental-age matched children were found (e.g. Adams & Markham, 1991; Moore et al., 1997). These results tended to be found when more ‘basic’ emotion-perception tasks that made fewer demands on information-processing capabilities were used. According to Moore (2001) these findings suggest that emotion-recognition capacities may therefore be intact in people with an intellectual disability and that impaired performance on emotion recognition tasks is a reflection of the cognitive-intellectual impairment associated with this group of people. Specifically, Moore (2001) proposed that impaired performance on emotion recognition tasks might reflect IQ-related deficits in memory and attention, in imagination and in processing static or ambiguous stimuli.

### **Limitations of emotion recognition studies**

There are a number of limitations associated with studies of the emotion recognition capabilities of people with an intellectual disability that may impact upon the extent to which conclusions regarding the nature and origin of any observed impairment

may be drawn. For example, much of the literature in this area has focussed on examining the emotion recognition capabilities of specific groups of people with an intellectual disability, such as those with Autism Spectrum Disorder (e.g. Feldman et al., 1993; Hobson et al., 1988) or Down syndrome (Hippolyte et al., 2008; Williams et al., 2005). Results from these studies cannot therefore be generalised to people with an intellectual disability of unknown aetiology, who comprise the vast majority of this group (Harris, 2006). Additionally, there are methodological considerations associated with some studies that have examined emotion recognition ability in people with an intellectual disability more generally. For example, some studies recruited a heterogeneous sample in which some participants had received a diagnosis of specific disorders known to be associated with impaired emotion recognition (e.g. people with Autism Spectrum Disorder, Garcia-Villamasir et al., 2010) or did not control for other co-morbidities, such as schizophrenia, dementia or depression (Moore, 2001). Inclusion of participants with such co-morbid diagnoses that have a known impact on emotion recognition might therefore have resulted in an over-estimation of any observed emotion recognition impairment in people with an intellectual disability.

Furthermore, studies have varied in terms of the stimulus materials used and the response methods required. Several studies have used black and white photographs of human faces, with the majority of these studies having used Ekman and Friesen's (1976) Pictures of Facial Affect (Rojahn, Lederer & Tassé, 1995). However, other studies have used a series of photographs of the same young female (Levy et al., 1960), have produced their own images (e.g. Maurer & Newbrough, 1987) or used cartoon stimuli (e.g. Brosigle et al., 1986). There is some evidence to suggest that emotion recognition accuracy is improved when photographs of human facial emotions are used, compared with comic strip stimuli or graphic representations (Lambert & Defays, 1978; Rojahn, Lederer & Tassé, 1995). Additionally, McKenzie et al. (2001) highlighted the importance of situational clues in communicating information about the emotions of others. These authors found that emotion recognition accuracy improved when adults with an intellectual disability were asked to identify emotions from a photograph with contextual information available, when

compared to line drawings; yet the majority of research in this area, to date, has been based upon studies that used either line drawings or simple black and white photographs of the face in isolation (Moore, 2001). Studies have also varied in terms of the task paradigms used. Some required participants to match a target stimulus to a response set, others involved identification of a target emotion from a number of distracters and others asked participants to rate the intensity of an emotion along a continuum. These tasks differed in terms of their relative complexity and it can therefore be difficult to determine the extent to which significant findings reflected impaired emotion recognition capabilities per se vs. the impact of IQ-related factors in people with intellectual disabilities. This is a particular issue in studies that did not employ any control task (Moore, 2001).

Moreover, studies also differed in terms of the range of emotions evaluated: some studies examined only recognition of two basic emotions (happiness and sadness, e.g. Levy et al., 1960; Rojahn, Kroeger & McElwain., 1995; Rojahn et al., 1995) and others simultaneously examined recognition of eight emotions (Sogon & Izard, 1985). Therefore, the extent to which the findings of these studies may generalise to the real-world experiences of people with learning disabilities is unclear.

Including a control task can account for the potential effects of differences in information-processing capacities between groups of participants with and without intellectual disability (Zaja & Rojahn, 2008). However, most studies in this area, to date, have not employed any control task, against which to compare performance on the emotion recognition tasks (e.g. Gray et al., 1983; Woodcock & Rose, 2007). Moreover, Moore (2001) highlighted that a single control task might not be sufficient to account for all IQ-related information processing factors. The control task and emotion recognition tasks must be of comparative complexity for a study to provide further evidence to support or refute the emotion specificity hypothesis. However, establishing whether the levels of abstraction required for a control task are similar to those involved in accurate recognition and identification of emotional state is an inherently complex task (Moore, 2001).

### **Aims of present study**

The present study aims to further evaluate the emotion specificity hypothesis, by replicating and expanding upon the study by Rojahn et al. (1995). Furthermore, the present study aims to overcome some of the methodological shortcomings associated with previous research, by including control tasks (i.e. tasks that are parallel versions of the emotion recognition tasks, that require processing of visual information and equivalent response methods, but without any emotion recognition component) and by including both chronological and mental age-matched control groups. Emotion recognition stimuli that cover a wide range of emotions and varied task paradigms are used in order to overcome the limitation of the study by Rojahn et al. (1995) that used only happy, sad and neutral expressions.

The use of emotion recognition task stimuli with varying degrees of contextual information available also allows further examination of the impact of context on emotion recognition accuracy and aims to enhance the ecological validity of any significant findings.

In relation to these aims, the following hypotheses are made:

Further support for the emotion specificity hypothesis will be found, that is:

1. (a) Adults with an intellectual disability will perform less well, overall, on emotion recognition tasks, compared with non-learning disabled chronological age matched adults.
1. (b) Adults with an intellectual disability will perform less well, overall, on emotion recognition tasks, compared with a group of children, matched for 'mental age'.
2. (a) Adults with an intellectual disability will perform less well overall on control tasks without any emotion recognition demands, compared with non-learning disabled, chronological age matched controls.
2. (b) Adults with an intellectual disability will not differ significantly on control tasks, without any emotion recognition demands, compared with 'mental age' matched child controls.

It is also hypothesised that:

3. (a) The type of stimuli used (i.e. line drawings, photographs with and without context) will effect performance on emotion recognition tasks.
3. (b) The type of stimuli used (i.e. line drawings, photographs with and without context) will effect performance on control tasks.
4. (a) The type of task paradigm used (i.e. naming, recognition from a choice of nine or a choice of two options) will effect performance on emotion recognition tasks.
4. (b) The type of task paradigm used (i.e. naming, recognition from a choice of nine or a choice of two options) will effect performance on control tasks.

## **Methodology**

### **Participants**

Three groups of participants were recruited into the study:

1. Participants with an intellectual disability (ID, n = 23)
2. A group of children, who were recruited as a 'mental age' matched control group ('child control group', n = 23).
3. A control group of adult participants who did not differ significantly from the intellectual disability group with respect to age and sex ('adult control group', n = 23).

#### *Inclusion and Exclusion Criteria*

Inclusion and exclusion criteria for each participant group are presented in Table 1 and are discussed in further detail in the 'recruitment' section.

Table 1. Inclusion and exclusion criteria for each of the three participant groups.

	Inclusion Criteria	Exclusion Criteria
Intellectual Disability Group	<p>Diagnosed learning disability (i.e. full-scale IQ score &lt; 70; impairment in two or more areas of adaptive functioning and onset before age 18)</p> <p>Adequate verbal communication to perform tasks</p> <p>Able to consent to participate in the study</p>	<p>Known major psychiatric disorder (including schizophrenia and dementia)</p> <p>Significant visual impairment</p> <p>Current prescribed psychotropic medication</p> <p>Comorbid diagnosis (e.g. of Autism Spectrum Disorder or Down Syndrome).</p>
Child Control Group	<p>Adequate verbal communication to perform tasks</p> <p>Able to consent to participate in the study and no parental objections made/parental consent obtained.</p>	<p>Diagnosed intellectual disability or other developmental disorder</p> <p>Major psychiatric disorder</p> <p>Significant visual impairment</p>
Adult Control Group	<p>Able to consent to participate in the study</p>	<p>Major psychiatric or neurological disorder (including schizophrenia and dementia)</p> <p>Significant visual impairment</p>

## **Sample Size**

A power calculation was calculated to establish the sample size necessary to achieve statistical power on the basis of a 3-group ANOVA being carried out. Previous studies that tested the emotion specificity hypothesis both directly and indirectly found effect sizes that varied from medium - large (Rojahn et al., 1995; Wishart et al., 2007; Williams et al., 2005). According to Cohen (1992), if a medium-large effect size is assumed, a 3-group ANOVA with a power of 0.8 and  $\alpha = 0.05$  requires 30 participants to be recruited into each group. If a large effect size is assumed, the corresponding number of participants needed in each group is 20.

## **Recruitment**

### *Participants with an intellectual disability*

The group of participants with an ID were recruited from Community Learning Disability Teams in the local area and the Learning Disabilities Forensic Service. All participants met the criteria for intellectual disability. That is, they had been assessed as having an IQ score of less than 70, using either the third or fourth edition of the Wechsler Adult Intelligence Scales (WAIS-III or WAIS-IV), had significant deficits in at least two areas of adaptive functioning and these deficits had presented before the age of 18.

Some participants in this group lived in the community, with varying degrees of support ( $n = 9$ ). Other participants in this group were living in hospital accommodation at the time of recruitment ( $n = 14$ ). Clinicians working within the teams were given information about the study and the inclusion/exclusion criteria and were asked to identify potential, eligible participants from their caseload and to provide them with information about the study (Appendix 6). Permission was sought for the researcher to contact the individual at a later date. Willing participants were contacted by telephone or in person and arrangements were made to meet with the researcher at a mutually convenient time. Participants who were hospital inpatients were seen either in their hospital accommodation or at a day service they attended. Participants who were living in the community were either seen at the same day

service, or in their home. Participants were encouraged to have someone they trusted and knew well present during testing. Informed consent was obtained from all participants, in the presence of a witness (Appendix 7).

#### *Child control group*

Participants in the child control group were recruited from After School Clubs in the local area. Information about the study was circulated to eligible children and their parents (Appendix 8) and informed consent from parents for their children's participation was sought. The researcher (JLS) attended the school/After School Club and met with children on an individual basis to obtain assent from the child and administer the tasks (Appendix 9).

#### *Adult control group*

Potential participants in the adult control group were recruited from volunteers known to the research team (i.e. friends, family and colleagues), using a snowball sampling method. Contact was made via an email that gave detail about the study and asked participants to take part in the study via an online link. Individuals were informed that their participation would be taken as an indication of their consent and contact details for the researcher and an independent contact were given, in order to address any questions potential participants had.

### **Ethical Approval**

Ethical approval to recruit the group of participants with an intellectual disability and the child control group was sought and granted by the NHS Research Ethics Committee (Appendix 10). Additionally, ethical approval to recruit children from schools and After School Clubs within the local area was sought and granted by the Education Department (Appendix 11). Ethical approval to recruit the adult control group was sought and granted by the University of Edinburgh's Health in Social Sciences Ethics Committee.

## Measures

### *Estimating cognitive ability:*

The Learning Disability Screening Questionnaire (LDSQ: McKenzie & Paxton, 2006; Paxton et al., 2008) and Child and Adolescent Intellectual Disability Screening Questionnaire (CAIDS-Q: McKenzie et al., 2012) were completed for participants in the LD and child groups, respectively. These measures were completed using information from an informant who knew the participant well, e.g. teacher, support worker or healthcare professional. Each of the measures consists of seven yes/no items (e.g. ‘can the client/child read?’). Each item is scored 1 or 0 points, according to pre-defined scoring criteria and a percentage score is calculated. These measures have been found to correlate highly with IQ ( $P < 0.001$ ) and have good specificity (85.5%) and sensitivity (96.7%). The available data on the correlation of the LDSQ and CAIDS-Q with the Full-Scale IQ scores on the Wechsler Intelligence Scales for Children (WISC) and the Wechsler Adult Intelligence Scales (WAIS), respectively, were used in order to calculate a regression equation that allowed estimated equivalent IQ scores for the two participant groups to be calculated, i.e. provided an estimation of ‘mental age’ for participants in the intellectual disability and child control groups.

### *Emotion recognition measures:*

The ‘Feelings and Emotions’ assessment (McKenzie et al., 2001) was administered to all participants. This measure comprises three sets of materials depicting nine emotions: happy, sad, afraid, angry, bored, worried, surprised, disgust and a neutral expression.

The three sets of materials consisted of:

- (i) Line drawings,
- (ii) Photographs of the face only (‘no context’), and
- (iii) Photographs of people displaying the emotion in context, e.g. someone looking scared holding a snake (‘with context’).

The line drawings were commissioned by one of the authors (KMcK) and the emotion photographs were sourced from Flickr (<https://www.flickr.com/>). All had a creative commons license that allowed their re-use.

Each of the three sets of pictures comprised 3 separate tasks:

- (i) emotion naming/labelling,
- (ii) emotion recognition of target emotion from a choice of 9
- (iii) Emotion recognition of target emotion from a choice of 2.

The emotion labelling task involved presenting participants with individual pictures depicting each of the nine emotions. Participants were asked to name the emotion shown in the picture. The first emotion recognition task involved presenting all nine emotion pictures simultaneously and the participant was asked to choose the picture that matched the target emotion, e.g. ‘Which picture shows a person who is scared?’ In the second emotion recognition task, the participant was asked to identify the target emotion from a choice of two. Thus, the task demands were varied. All correct responses were given a score of one and were scored according to pre-defined scoring criteria. Total scores were calculated to give an overall correct score, as well as a total correct score for each task paradigm (naming, choice of 9 and choice of 2) and for each stimulus type (line drawings, photographs without context and photographs with context).

The ‘Feelings and Emotions’ assessment was originally used in the studies by McKenzie et al. (2001). The assessment was revised to include expressions of disgust, surprise and neutrality. The pictures in the revised version of the Feelings and Emotions Assessment were initially piloted with a group of people who worked in the area of child development and/or intellectual disability and emotion research. The chosen pictures were subsequently piloted with a sample from the general population in order to determine the degree of agreement with respect to the emotions depicted in each picture. The percentage correct profiles were then compared with the profiles obtained for the original version of the ‘Feelings and

Emotions' measures, in order to ensure they were broadly consistent. The measure has high levels of reliability, Cronbach's  $\alpha = .940$ .

### *Control Tasks*

All participants also completed 'control tasks'. These tasks were parallel versions of the emotion recognition tasks that did not involve any emotion recognition component and have been used by previous authors (e.g. McKenzie et al., 2001; Matheson & Jahoda, 2005). Participants were asked to identify features (i.e. eye/hair colour) of line drawings, basic photographs and photographs with more detail/context, using the same task paradigms as in the emotion recognition tasks (labelling and recognition from a choice of 9 and a choice of 2). These tasks were administered in order to control for the cognitive demands of the tasks and to therefore test the emotion specificity hypothesis. Responses were scored as described above for the emotion recognition tasks. The control tasks had similar high levels of reliability to the emotion recognition tasks, Cronbach's  $\alpha = .936$ .

### **Procedure**

Participants in the adult control group completed an online version of the above-described tasks, at a time convenient to them. The tasks were administered via Survey Monkey, a free online survey software and questionnaire tool. Completion of the online version of the tasks took around 30 minutes.

Participants in both the intellectual disability and child control groups completed the tasks on a one-to-one basis with the researcher. The participant information sheet was reviewed and participants were encouraged to ask questions. Informed consent was obtained prior to completing the tasks. Images were presented on a laptop, in the form of a PowerPoint presentation and participant responses were recorded by the researcher on a response sheet (Appendix 12). Participants were encouraged to voice their responses, or point/gesture, as appropriate. Completion of the tasks in this way took up to 30 minutes.

Basic demographic information, including age and sex, was recorded for each participant and the LDSQ and CAIDS-Q completed for participants in the intellectual disability and child control groups, respectively.

## **Results**

### **Data analysis**

The Statistics Package for the Social Sciences (IBM SPSS Statistics 21.0) was used for all statistical analyses. Prior to undertaking statistical analyses, data were explored to identify any missing data and to determine whether the data met the criteria for parametric statistical analyses.

### **Demographic information**

The demographic characteristics of each group are shown in Table 2. The intellectual disability and adult control group were well matched in terms of age. There were significantly more females recruited into the child control group compared with the other two participant groups.

The intellectual disability group had a mean score of 68.3 (SD 7.7) on the Learning Disability Screening Questionnaire and the child control group had a mean score of 74.2 (SD 9.4) on the Child and Adolescent Intellectual Disability Screening Questionnaire. There was a significant difference between these scores ( $P = 0.025$ ).

Table 2. Demographic information for each participant group

	<b>Intellectual Disability Group (n = 23)</b>	<b>Child Control Group (n = 23)</b>	<b>Adult Control Group (n = 23)</b>	<b>p-value for difference*</b>
<b>Sex</b>				
<b>Male</b>	18 (78%)	11 (48%)	19 (83%)	0.023
<b>Female</b>	5 (22%)	12 (52%)	4 (17%)	
<b>Mean age (SD) (Range)</b>	45.7 (11.3) (25 – 61)	10.4 (1.7) (7 – 13)	41.1 (12.0) (26-61)	0.186
<b>Mean LDSQ<sup>1</sup> Score (SD)</b>	68.34 (7.69)	N/A	N/A	0.025
<b>Mean CAIDS-Q<sup>2</sup> Score (SD)</b>	N/A	74.24 (9.43)	N/A	

Abbreviation: N/A, not applicable

\* based on Fisher's Exact Test for sex and t-tests for age (comparing only ID group with Adult Control group) and comparison between LDSQ and CAIDS-Q scores

<sup>1</sup> LDSQ = Learning Disability Screening Questionnaire (McKenzie & Paxton, 2006)

<sup>2</sup> CAIDS-Q = Child & Adolescent Intellectual Disability Screening Questionnaire (McKenzie et al., 2012)

## **Feelings & Emotions Assessment**

The means and standard deviations, along with the range, for the scores on the emotion and control tasks, stratified by task paradigm and stimulus type for each of the three participants groups are presented in Appendix 13.

## **Main statistical analyses**

### *Analyses relevant to the emotion specificity hypothesis*

In order to establish whether there was any relationship between participant group (intellectual disability, adult and child control) and task type (emotion recognition and control), a 3(groups) x 2(task) two-way repeated measures ANOVA was carried out. Total overall scores on the emotion recognition and control tasks were entered as a within-subjects factor and participant group was a between-subjects factor. There was a significant Task x Group interaction,  $F(2,65) = 47.83$ ,  $P < 0.001$ . In addition, there was a significant main effect of both task,  $F(1,65) = 635.38$ ,  $P < 0.001$  and group,  $F(2,65) = 41.95$ ,  $P < 0.001$ . Further analyses were carried out and described as follows in order to test hypotheses 1(a), 1(b) and 2(a) and 2(b) by determining which groups differed from one another on which of the two tasks. An overview of the relative overall performance of the three participant groups on the emotion recognition and control tasks are shown in Table 3.

### *Hypotheses 1(a) and 1(b)*

In order to test the hypotheses that adults with intellectual disability would perform less well on emotion recognition tasks than chronological and mental age matched, non-learning disabled controls, a one-way ANOVA was carried out to compare the relative overall performance of the three groups on the emotion recognition tasks. Group was the independent factor and the overall score on the emotion recognition tasks was the dependent variable. This analysis showed that the three groups differed significantly on the emotion recognition tasks,  $F(2,65) = 55.22$ ,  $P < 0.001$ .

Therefore, subsequent post-hoc analyses were carried out using the Games-Howell procedure. This method was chosen because Levene's test was significant; indicating that the assumption of homogeneity between groups might have been violated. The Games-Howell procedure is preferable in this instance (Field, 2012). These post-hoc tests revealed that, on the emotion tasks, the intellectual disability group performed significantly less well than both the adult and child control groups,  $P < 0.001$ ,  $d = -2.56$  and  $P < 0.001$ ,  $d = -1.97$ , respectively. The child control group also performed significantly less well than the adult control group on the emotion recognition tasks,  $P < 0.001$ ,  $d = -1.30$ .

#### *Hypotheses 2(a) and 2(b)*

A one-way ANOVA was carried out in order to compare the relative overall performance of the three groups on the control tasks and to test the hypotheses that the adults with intellectual disability would perform less well on control tasks than the chronological age matched control group and would not differ significantly from the mental age matched control group.

Group was the independent factor and the overall score on the control tasks was the dependent variable. This analysis showed that the three groups differed significantly on the control tasks,  $F(2,65) = 19.32$ ,  $P < 0.001$ .

Post-hoc analyses, using the Games-Howell procedure as described above, revealed that the intellectual disability group performed significantly less well than both the child ( $P = 0.001$ ,  $d = -1.36$ ) and adult control groups ( $P = 0.001$ ,  $d = -1.25$ ). There was no significant difference between the performance of the adult and child control groups on the control tasks,  $P = 0.176$ .

#### *Controlling for 'mental age'*

Given that the intellectual disability group had significantly lower estimated equivalent IQ scores than the child control group, in order to adjust for estimated equivalent IQ (as measured by the LDSQ and CAIDS-Q), the above described

hypotheses were tested further, controlling for the effect of differences in LDSQ/CAIDS-Q score.

Univariate ANOVA, with overall emotion recognition score as the dependent variable, group as a fixed factor and LDSQ/CAIDS-Q score entered as a covariate revealed that the significant difference between the performance of the intellectual disability and child control groups remained,  $F(2,46) = 19.79, P < 0.001$ .

A second univariate ANOVA, with overall control task score as the dependent variable, group as a fixed factor and LDSQ/CAIDS-Q score entered as a covariate similarly revealed that the significant difference between the performance of the two groups remained,  $F(2,45) = 10.3, P < 0.001$ .

Table 3. Overview of results of pairwise comparisons of the intellectual disability, child and adult control groups on the emotion recognition and control tasks.

	Group	Mean	Standard Deviation	Pairwise comparisons					
				ID vs Child		ID vs Adult		Child vs Adult	
				p-value	Effect size*	p-value	Effect size*	p-value	Effect size*
Emotion Recognition Tasks: Total Score	ID	49.8	11.5	<0.001	-1.97	<0.001	-2.56	<0.001	-1.30
	Child	66.7	3.9						
	Adult	72.1	4.4						
Control Tasks: Total Score	ID	71.7	9.3	0.001	-1.36	0.001	-1.25	0.176	N/A
	Child	80.1	0.8						
	Adult	80.0	1.4						

\* Effect size – Cohen's d

## **Impact of stimulus type**

### **(i) Contextual information: Emotion Recognition (Hypothesis 3(a))**

#### *Intellectual disability group*

The intellectual disability group had a mean (SD) score of 15.5 (3.6) on the emotion recognition tasks that involved line drawings; 17.0 (4.6) on tasks that involved stimuli with no contextual information and 17.4 (4.6) on tasks that involved stimuli with contextual information available.

A within-subjects ANOVA was carried out to test the hypothesis that the stimulus type used would have an effect on response accuracy on the emotion recognition tasks. There was a significant main effect of task type,  $F(2,42) = 4.708$ ,  $P = 0.014$ . Pairwise comparisons showed that the intellectual disability group performed significantly better on the tasks that included contextual information, only when compared with tasks that used line drawings ( $P = 0.034$ ,  $d = 0.46$ ). No significant differences were found when comparing performance on tasks with context with tasks with no context ( $P = 1.00$ ) and when comparing the 'no context' tasks with tasks that used line drawings ( $P = 0.066$ ).

#### *Control Groups*

The child control group had a mean (SD) score of 20.8 (1.9) on the emotion recognition tasks that involved line drawings; 22.7 (2.1) on tasks that involved stimuli with no contextual information and 23.2 (1.7) on tasks that involved stimuli with contextual information available

A significant main effect of task type was found when the analysis was repeated for the child control group  $F(2,44) = 11.763$ ,  $P < 0.001$ . Post-hoc comparisons indicated that the child control group performed significantly less well on the tasks that involved line drawings, when compared with images both without context ( $P = 0.010$ ,  $d = -0.95$ ) and with context ( $P < 0.001$ ,  $d = -1.33$ ). There was no significant

difference between the performance of the child control group on tasks with and without contextual information ( $P = 0.873$ ).

The adult control group had a mean (SD) score of 23.9 (0.3) on the emotion recognition tasks that involved line drawings; 24.4 (2.1) on tasks that involved stimuli with no contextual information and 23.8 (3.0) on tasks that involved stimuli with contextual information available. No significant main effect of task type was found in the model for the adult control group.

An overview of the findings related to the differential performance of each of the three participant groups, dependent upon the stimuli used is presented in Table 4.

Table 4. Overview of findings comparing the impact of stimulus type on emotion recognition task performance for each participant group

Group	Pairwise comparisons					
	Line drawing vs 'no context'		Line drawings vs 'with context'		'no context' vs 'with context'	
	p-value	Effect size*	p-value	Effect size*	p-value	Effect size*
ID	0.066	N/A	0.034	-0.46	1.00	N/A
Child	0.010	-0.95	<0.001	-1.33	ns	N/A
Adult	ns	N/A	Ns	N/A	ns	N/A

\* Cohen's d

ns = not significant; N/A = not applicable.

## **(ii) Contextual information: Control Tasks (Hypothesis 3(b))**

### *Intellectual disability group*

The intellectual disability group had mean (SD) scores of 25.0 (2.5) on the control tasks that involved line drawings, 23.1 (4.0) on the photographs without contextual information and 23.7 (3.5) on the photographs with additional detail/context shown.

To test the hypothesis that stimulus type would have an effect on response accuracy on the control tasks, a within-subjects ANOVA was carried out, as described above. There was a significant main effect of task type,  $F(2,42) = 8.275$ ,  $P = 0.001$ . Pairwise comparisons showed that the intellectual disability group performed significantly better on the control tasks that involved line drawings, compared with photographs without context ( $P = 0.013$ ,  $d = 0.57$  and compared with photographs with context ( $P = 0.050$ ,  $d = 0.43$ ). No significant differences were found when comparing performance on photographs with context with photographs with no context ( $P = 0.149$ ).

### *Control Groups*

The child control group had a mean (SD) score of 27.0 (0.2) on the control tasks that involved line drawings; 26.8 (0.5) on tasks that involved stimuli with no contextual information and 26.9 (0.3) on tasks that involved stimuli with additional detail/contextual information available.

There was no significant main effect of task type in the model for the child control group,  $F(2,44) = 1.932$ ,  $P = 0.157$ .

The adult control group had a mean (SD) score of 27.0 (0.2) on the control tasks that involved line drawings; 26.6 (0.7) on tasks that involved stimuli with no contextual information and 26.5 (0.8) on tasks with contextualised stimuli.

There was a significant main effect of task type in the model for the adult control group:  $F(2,44) = 1.406$ ,  $P = 0.009$ . Adult control participants performed significantly

better on control tasks that involved line drawings compared with tasks that involved photographs with context ( $P = 0.014$ ,  $d = 0.86$ ).

## **Impact of Task Paradigm**

### **(i) Task paradigm: Emotion recognition (Hypothesis 4(a))**

#### *Intellectual disability group*

The intellectual disability group had mean (SD) scores of 11.9 (3.5) on the emotion naming tasks; 14.1 (5.5) on tasks that involved identifying a target emotion from a choice of nine and 23.8 (3.5) on tasks that involved identification from a choice of two.

A within-subjects ANOVA was carried out to test the hypothesis that task paradigm would impact response accuracy on the emotion recognition tasks. This illustrated a significant main effect of task type,  $F(2,42) = 175.075$ ,  $P < 0.001$ .

Post-hoc comparisons indicated that the intellectual disability group performed significantly better when asked to identify the target emotion from a choice of 2 pictures compared with both naming the emotion ( $P < 0.001$ ,  $d = 3.4$ ) and when asked to identify the target from a choice of 9 pictures ( $P < 0.001$ ,  $d = 2.10$ ). The intellectual disability group also performed significantly more accurately when required to identify the target from a choice of 9 pictures compared with when asked to name the emotion in the picture ( $P = 0.025$ ,  $d = 0.48$ ).

#### *Control Groups*

The child control group had mean (SD) scores of 18.8 (1.8) on the emotion naming tasks and 21.4 (2.4) and 26.4 (0.7) on the recognition from a choice of nine and a choice of two images, respectively. The adult control group had corresponding mean scores of 19.7 (2.9), 25.5 (2.1) and 26.9 (0.3) on the tasks that involved emotion naming, recognition from a choice of nine and from a choice of two images, respectively.

A significant main effect of task type was found when the analysis was repeated for the child control group and the adults control group,  $F(2,44) = 153.496$ ,  $P < 0.001$  and  $F(2,44) = 102.168$ ,  $P < 0.001$ , respectively.

Post-hoc analyses for both groups indicated that participants performed better when asked to identify the target emotion from a choice of 2 images, compared with when asked to name the emotion ( $P < 0.001$ ,  $d = 5.57$  for the child control group and  $P < 0.001$ ,  $d = 3.49$  for the adult control group) and when asked to identify the target emotion from a choice of 9 ( $p < 0.001$ ,  $d = 2.83$  for the child control group and  $P = 0.012$ ,  $d = 0.93$  for the adult control group).

An overview of the findings regarding the relative performance of the three participant groups, according to task paradigm used are presented in Table 5.

Table 5. Overview of findings comparing the impact of task paradigm on emotion recognition task performance for each participant group

Group	Pairwise comparisons					
	Naming vs Choice 9		Naming vs choice 2		Choice 9 vs Choice 2	
	p-value	Effect size*	p-value	Effect size*	p-value	Effect size*
ID	0.025	-0.48	<0.001	-3.4	<0.001	-2.10
Child	ns	N/A	<0.001	-5.57	<0.001	-2.83
Adult	ns	N/A	<0.001	-3.49	0.012	-0.93

\*Cohen's d  
ns = not significant; N/A = not applicable.

## **(ii) Task Paradigm: Control Tasks (Hypothesis 4(b))**

### *Intellectual disability group*

The intellectual disability group had a mean (SD) score of 23.6 (3.1) on tasks that required participants to name the hair or eye colour of stimulus images. On tasks that required identification of target hair/eye colour from a choice of 9 images and a choice of 2 images, the mean scores for this group were 22.7 (4.5) and 25.4 (2.1), respectively.

The hypothesis that task paradigm would have an effect on response accuracy on the control tasks was tested using a within subjects ANOVA. This illustrated a significant main effect of task type,  $F(2,42) = 16.002$ ,  $P < 0.001$ .

Post-hoc comparisons indicated that the intellectual disability group performed significantly better when asked to identify hair/eye colour from a choice of 2 pictures compared with both naming the colour ( $P < 0.001$ ,  $d = 0.68$ ) and when asked to identify the target from a choice of 9 pictures ( $P = 0.001$ ,  $d = 0.77$ ). There was no significant difference between the performance of the intellectual disability group when asked to name the hair/eye colour compared with when asked to identify it from a choice of 9 images ( $P = 0.094$ )

### *Control Groups*

The child control group had a mean (SD) score of 26.8 (0.5) on tasks that required participants to name the hair or eye colour of stimulus images. On tasks that required identification of target hair/eye colour from a choice of 9 images and a choice of 2 images, the mean scores for the child control group were 26.9 (0.5) and 27.0 (0.0), respectively.

The adult control group had corresponding mean scores of 26.3 (1.0) on naming tasks, 26.8 (0.6) on tasks the required selecting the correct response from a choice of 9 and 27.0 (0.2) on tasks that required selecting from a choice of 2 images.

There was no significant effect of task paradigm in the model for the child control group,  $F(2,44) = 1.981$ ,  $P = 0.150$ .

There was a significant main effect of task paradigm in the model for the adult control group,  $F(2,44) = 6.626$ ,  $P = 0.003$ . Planned comparisons revealed that adult control participants performed significantly better when asked to identify hair or eye colour from a choice of two images, compared with when asked to name the colour spontaneously ( $P = 0.013$ ,  $d = 0.97$ ).

### **Further analyses relevant to the emotion specificity hypothesis**

As described, the control tasks on which the intellectual disability group performed with significantly greater comparative accuracy were those in which the stimuli used were line drawings and on control tasks that involved choosing the correct response from a choice of two options. Exploratory analyses were therefore carried out comparing the performance of the three participant groups on these sub-tasks. This was done in order to establish whether the performance of the intellectual disability group was equivalent to that of either control group on either of these two specific control tasks. If this was found to be the case, it was anticipated that further analyses comparing the performance of the three groups on the corresponding emotion recognition sub-tasks could be carried out. This would allow further evaluation of the emotion specificity hypothesis.

#### *Control tasks: Line drawings*

General linear modelling, with group as a fixed factor and total score on the line drawing control tasks as the dependent variable revealed a significant main effect of participant group:  $F(2,68) = 13.34$ ,  $P < 0.001$ .

Post hoc comparisons, using the Games-Howell procedure, as described previously, showed that the intellectual disability group performed significantly less well than both the adult and child control groups ( $P = 0.004$  for each).

*Control tasks: Recognition from a choice of two response options*

General linear modelling, with group as a fixed factor and total score on the control task paradigm that involved identifying the correct response from a choice of two as a dependent variable revealed a significant main effect of participants group,  $F(2,68) = 13.71, P < 0.001$ .

Post hoc analyses, as described above revealed that the intellectual disability group performed significantly less well than both the adult ( $P = 0.005$ ) and child ( $P = 0.004$ ) control groups.

Therefore, the between-group differences remained when only the control tasks on which the intellectual disability group performed comparatively more accurately were included in the analyses. That is, the intellectual disability group performed significantly less well than the child control group on the control tasks that involved only line drawings and control tasks that required selecting a response from a choice of two options. Therefore, the emotion specificity hypothesis was not tested further.

## Discussion

This study aimed to further evaluate the ability of adults with intellectual disability to recognise and interpret facial expressions of emotion. Of particular interest was whether further evidence to support the emotion specificity hypothesis could be found. The study also evaluated the impact of task paradigm, emotion stimulus type and the amount of contextual information available on the ability of adults with intellectual disability to recognise facial emotional expressions.

### *Emotion Specificity Hypothesis*

The group of participants with an intellectual disability demonstrated overall impairment in facial emotion recognition when compared with both an adult and child control group. This confirms previous, early findings in this area (Moore, 2001; Zaja & Rojahn, 2008). However, the intellectual disability group were also relatively impaired on a control task with no emotion recognition component, in comparison with both the adult and child control groups. This finding contradicts that of Rojahn et al. (1995) who found that, on a control task, the group of participants with intellectual disability performed equally as a child control group, recruited as a means of matching for 'mental age'. These findings led them to conclude that the emotion specificity hypothesis for people with an intellectual disability was supported. Thus, the findings of the present study do not support the emotion specificity hypothesis.

Although the present study aimed to replicate the study by Rojahn et al. (1995), there are several methodological differences that may, in part, account for the differences in findings between the two studies. Firstly, both the present study and the previous study included a control group of children that were recruited as a means of controlling for 'mental age'. The inclusion of a child control group is a methodological advantage over several other studies in this area that either did not recruit any control group or only compared performance against adult participants without intellectual disability. However, the way in which the child participants were 'matched' with the adults with an intellectual disability for mental age differed

between the two studies. Rojahn et al. (1995) matched the intellectual disability and child control groups according to scores on the Ravens Progressive Standard Matrices. The present study used IQ estimations produced by two screening questionnaires (LDSQ and CAIDS-Q for the intellectual disability and child participants groups, respectively). The LDSQ was initially devised by McKenzie and Paxton (2006) as a method of indicating whether or not someone is likely to meet the criteria for intellectual disability. It is a standardised measure with good reported levels of reliability and validity. The CAIDS-Q (McKenzie et al., 2012) is a parallel version of the LDSQ, for use with children and adolescents and is also a standardised measure with acceptable psychometric properties. These measures were chosen as a means of matching the intellectual disability and child control groups in the present study for two key reasons: use of a measure such as the Raven Standard Progressive Matrices test was felt to potentially make the time taken to complete the test battery too demanding and, as such, it was felt that this may make recruitment problematic. Secondly, measures used to match participants in previous studies, such as Raven's Matrices or the Peabody Picture Vocabulary test, (Hobson et al., 1989; Rojahn et al., 1995) measure receptive vocabulary and are primarily measures of verbal ability. Verbal function is only one facet of overall ability and therefore, matching on the screening questionnaires, which have been shown to predict overall IQ, was felt preferable.

In both the present study and the Rojahn et al. (1995) study, the child control group scored significantly higher than the intellectual disability group on the matching measures. Therefore, it is possible that the child control group may have outperformed the intellectual disability group on the emotion recognition measures and/or the control tasks as the group had a higher overall 'mental age'. However, Rojahn et al. (1995) reported that the significant task x group interaction held, when the analysis was repeated for these two groups, using analysis of covariance, with Raven Standard Progressive Matrices Test score entered as a covariate. They therefore concluded that, although group differences in visuo-spatial reasoning may have explained the variance in the main effects found in their primary analysis, they did not account for the performance differences that were critical to the support of

the emotion specificity hypothesis (i.e. the significant task x group interaction). Similarly, when the performance of the three participant groups in the present study was compared, controlling for the effect of ‘mental age’, as measured by LDSQ/CAIDS-Q score, the group differences remained on both the emotion recognition and control tasks. Nevertheless, the higher ‘mental age’ of participants in the child control group in the present study remains a limitation and must be borne in mind when interpreting the results.

Few previous studies in this area have used a control task against which to compare performance on the emotion recognition measures. A control task is fundamental to evaluating the emotion specificity hypothesis and, as such, was included in the design of the present study. Moore (2001) highlights the importance of a control task in terms of determining whether impairment in one domain (i.e. facial emotion recognition) is specific to that domain and therefore does not result from mental-age or IQ-related impairment, or whether it is not specific and may be accounted for by information-processing limitations. Thus, Moore (2001) recommends that a control task should involve the processing of information that is not specific to the domain in question. In keeping with this recommendation, the control tasks used in the present study were parallel versions of the emotion recognition tasks and involved participants being asked to state the hair or eye colour of stimulus images. The control tasks used by Rojahn et al. (1995) formed part of the Facial Discrimination Battery and involved making judgements about the age of people in the stimulus images. Rojahn et al. (1995) found no significant difference between the performance of the mental age matched control group of children and the participants with an intellectual disability on the control task. However, the present study found that adults with an intellectual disability demonstrated relative impairment on the control tasks compared with the mental age matched control group, a finding that questions the validity of the emotion specificity hypothesis. However, Moore (2001) highlights the importance of employing control tasks that are of equal complexity to the index (emotion recognition) tasks. Although the control tasks used in the present study meet the criteria proposed by Moore (2001) in terms of requiring the same response demands as the index task and using equivalent stimuli, it was not possible

to statistically estimate item difficulties in order to demonstrate that the tasks were of equal complexity. It does, however, make intuitive sense to propose that identifying hair and eye colour is a conceptually simpler task than identifying the emotions displayed by the same stimuli. Moreover, when exploratory analyses were carried out, comparing the performance of the intellectual disability and child groups on the control tasks on which the intellectual disability group performed best, the intellectual disability group remained relatively impaired in comparison with the child control group. Our research team is currently attempting to provide estimates of item difficulties, in order to establish whether the control tasks place equal demands on cognitive-intellectual ability as do the emotion recognition tasks.

#### *Impact of task paradigm and context*

The importance of using stimuli that are ecologically valid was highlighted by Moore (2001). The inclusion of a wide range of stimuli, covering nine different expressions of emotion is a relative strength of the present study, compared with the study by Rojahn et al. (1995) that included only happiness, sadness and a neutral expression. The present study found mixed results for the three participant groups in terms of the impact of the stimuli used in increasing response accuracy. Participants with an intellectual disability performed significantly better when images with contextual information were used compared with line drawings. The child control group performed significantly better on images both with and without context, compared with line drawings. There was no significant effect of the stimulus type on the performance of the adult control group. The results related to the performance of the intellectual disability and child control groups are broadly in keeping with the findings described by McKenzie et al. (2001). The images both with and without context used in the present study and in the study by McKenzie et al. (2001) are photographs of real people, and as such, have better ecological validity than do line drawings or schematic representations of faces. This finding has implications in terms of the interpretation of findings from previous studies that use cartoon or schematic based representations of emotions, which may therefore over-estimate the extent of any emotion recognition impairment observed in people with an intellectual disability (e.g. Weisman & Brosgole, 1994). Furthermore, that both adults with an

intellectual disability and children without an intellectual disability were more accurate at recognising images with contextual information available supports the recommendation that communication programmes for people with an intellectual disability should perhaps make use of photographs that have meaning to the individual, rather than symbols or line drawings (McKenzie et al., 2001).

As expected, the present study found that all participant groups performed better when asked to identify the target emotion from a choice of two images and performed least accurately when required to name the emotion in the target picture. This again supports the findings of McKenzie et al. (2001), who highlighted the importance of considering methodology when devising targeted approaches to improve emotion recognition abilities of people with an intellectual disability.

#### *Limitations*

The main limitations of the present study have been discussed, above. These include the fact that the intellectual disability and child control groups cannot be said to be matched on 'mental age' because the child group had significantly higher mean estimated equivalent IQ scores than the adults with intellectual disability. The difficulties associated with selecting a control task with equivalent task demands to the emotion recognition tasks is also a limitation associated with the present study and warrants further investigation.

An additional potential limitation of with the present study is associated with sampling and sample size. The participants recruited into the intellectual disability group included a number of individuals with a history of offending. Although little research comparing the emotion recognition capabilities of offenders compared with non-offenders with intellectual disability, there exists some preliminary evidence to suggest that offenders with intellectual disability might have better empathy and theory of mind abilities, including better performance on emotion recognition tasks (Proctor & Beail, 2007). Therefore, it is possible that the present study might underestimate the extent of emotion recognition impairment in people with intellectual disability, due to the inclusion of a disproportionate number of

participants with a history of offending. Furthermore, based on a priori power calculations, it was anticipated that 30 participants would be recruited into each group in order to ensure that the study had adequate statistical power. Therefore, given that only 23 participants were recruited into each group, the study might be underpowered. However, when power calculations were based upon an assumed large effect size, as found in a number of previous studies (e.g. Harwood et al., 1999; McKenzie et al., 2001; Owen et al., 2001), a sample size of 20 participants per group was required. Nevertheless, given that there is some inconsistency in the literature with regard to the very presence of emotion recognition impairment in people with intellectual disability, with some studies reporting that people with an intellectual disability did not differ significantly from a control group on some at least some emotion recognition tasks administered (e.g. Weisman & Brosigole, 1994) a larger sample size would have been preferable.

#### *Conclusions and future research*

Adults with an intellectual disability demonstrated relative impairment on tasks of facial emotion recognition when compared with chronological age matched participants and mental-age matched child participants. They also showed relatively impaired performance on control tasks, with no emotion recognition component, compared with both control groups. Therefore, the results of the present study do not support the emotion specificity hypothesis, although limitations as described above have limited our ability to test the hypothesis directly. Although it is possible that these results may instead support the proposal that information-processing limitations, rather than an emotion-specific deficit, may account for the observed emotion recognition deficits in adults with an intellectual disability, further examination of the emotion specificity hypothesis may be warranted. Therefore, future research should attempt to estimate item difficulties for the emotion recognition and control tasks in order to devise a control task with proven comparable levels of complexity to the emotion recognition tasks. This, in turn, will allow more definitive evidence for the existence, or otherwise, of the emotion specificity hypothesis to be evaluated.

Emotion recognition impairment is reported to be associated with poor social functioning in various groups of people, including those with intellectual disability. Poor socio-emotional functioning, in turn, has been found to be associated with a number of negative outcomes. These included failure in community and work placements, greater frequency of aggressive and antisocial behaviour and feelings of loneliness and rejection (e.g. Best-Sigford et al., 1982; Martin et al., 1986). It has been proposed that the socio-emotional vulnerabilities that arise, at least in part, from impaired emotion recognition competence may contribute to increased risk for mental illness in people with intellectual disability (Rojahn & Warren, 1997; Rojahn et al., 1995). Future research should continue to examine evidence for the possible causes of emotion recognition deficits in people with intellectual disability in order to inform interventions that aim to improve this fundamental skill.

## References

Adams, K. & Markham, R. 1991 'Recognition of affective facial expressions by children and adolescents with and without mental retardation', *American Journal on Mental Retardation* 96: 21-28.

Bandura, A. 1986 *Social functions of thought and action: a social cognitive theory*. Englewood Cliffs, New Jersey: Prentice-Hall.

Best-Sigford, B., Bruininks, R.H., Lakin, K.C., Hill, B.K. and Heal, L.W. 1982 'Resident release patterns in a national sample of public residential facilities', *American Journal on Mental Deficiency* 87: 130-140.

Bouras, N. and Drummond, C. 1992 'Behavior and psychiatric disorders of people with mental handicaps living in the community', *Journal of Intellectual Disability Research* 36: 349-357.

Brosigole, L., Gioia, J.V. and Zingmond, R. 1986 'Facial and postural affect recognition in the mentally handicapped and normal young children', *International Journal of Neuroscience* 30: 127-144.

Cohen, J. 1992 'A power primer', *Psychological Bulletin* 112 (1): 155-159.

Ekman, P. and Friesen, W.V (1976) *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W.V. and Ellsworth, P. 1972 *Emotion in the human face: Guidelines for research and an integration of findings*. Oxford, England: Pergamon Press.

Feldman, R. S., McGee, G. G., Mann, L. and Strain, P. 1993 'Nonverbal affective decoding ability in children with autism and in typical preschoolers', *Journal of Early Intervention* 17 (4): 341–350.

Field, A. 2012 *Discovering Statistics Using IBM SPSS Statistics. 4<sup>th</sup> Edition*. Sage: London.

Garcia-Villamizar, D., Rojahn, J., Zaja, R. H., and Jodra, M. 2010 'Facial emotion processing and social adaptation in adults with and without autism spectrum disorder', *Research in Autism Spectrum Disorders* 4 (4): 755-762.

Gray, J.M., Fraser, W.L. and Leudar, I. 1983 'Recognition of emotion from facial expression in mental handicap', *British Journal of Psychiatry* 142: 566-571.

Harris, J.C. 2006 *Intellectual disability: understanding its development, causes, classification, evaluation, and treatment*. Oxford University Press: New York.

Hext, L.J. and Lunskey, Y. 1997 'Relationships etc. – a social skills programme', *Habilitative Mental Healthcare Newsletter* 16: 7-10.

Hippolyte, L., Barisnikov, K., Van der Linden, M. and MacLean, Jr., W.E. 2008 'Face processing and facial emotion recognition in adults With Down syndrome', *American Journal on Mental Retardation* 113 (4): 292-306.

Hobson, R. P., Ouston, J. and Lee, A. 1988 'Emotion recognition in autism: coordinating faces and voices', *Psychological Medicine* 18: 911-923.

Hobson, R., P., Ouston, J., and Lee, A. 1989 'Recognition of emotion by mentally retarded adolescents and young adults', *American Journal on Mental Retardation* 93 (4): 434-443.

Hooker, C. and Park, S. 2002 'Emotion processing and its relationship to social functioning in schizophrenia patients', *Psychiatry Research* 112 (1): 41-50.

Lambert, J.L. and Defays, D. 1978 'La comprehension d'expressions facials chez des enfants arriérés mentaux et normaux', *Revue Suisse de Psychologie* 37: 216-224.

Leppänen, J.M. and Hietanen, J.K. 2001 'Emotion recognition and social adjustment in school-aged girls and boys', *Scandinavian Journal of Psychology* 42 (5): 429-435.

Levy, L.H., Orr, T.B. and Rosenzweig, S. 1960 'Judgements of emotion from facial expression by college students, mental retardates and mental hospital patients', *Journal of Personality* 28: 342-249.

Martin, J.E., Rusch, F.R., Lagomarcino, T. and Chadsey-Rusch, J. 1986 'Comparison between workers who are non-handicapped and mentally retarded: why they lose their jobs', *Applied Research in Mental Retardation* 7: 467-474.

Matheson, E. and Jahoda, A. 2005 'Emotional understanding in aggressive and nonaggressive individuals with mild or moderate mental retardation', *American Journal on Mental Retardation* 110 (1): 57-67.

Maurer, H. and Newbrough, J. R. 1987 'Facial expressions of mentally retarded and nonretarded children: I. recognition by mentally retarded and nonretarded adults', *American Journal of Mental Deficiency* 91 (5): 505-510.

McAlpine, C., Kendall, K., A. and Singh, N. N. 1991 'Recognition of facial expressions of emotion by persons with mental retardation', *American Journal on Mental Retardation* 96 (1): 29-36.

McKenzie, K., Matheson, E., McKaskie, K., Hamilton, L. and Murray, G.C. 2001 'A picture of happiness', *Learning Disability Practice* 4 (1): 26-29.

McKenzie, K. and Paxton, D. 2006 'Promoting access to services: the development of a new screening tool', *Learning Disability Practice* 9 (6): 17-21.

McKenzie, K., Paxton, D., Murray, G., Milanese, P. and Murray, A. 2012 'The evaluation of a screening tool for children with an intellectual disability: The Child

and Adolescent Intellectual Disability Screening Questionnaire', *Research in Developmental Disabilities* 33: 1068-1075.

Moore, D. G. 2001 'Reassessing emotion recognition performance in people with mental retardation: A review', *American Journal on Mental Retardation* 106 (6): 481-502.

Moore, D.G., Hobson, R.P. and Lee, A. 1997 'Components of person-perception: an investigation with autistic, nonautistic retarded and typically developing children and adolescents', *British Journal of Developmental Psychology* 15: 401-423.

Owen, A., Browning, M. and Jones, R.S.P. 2001 'Emotion recognition in adults with mild-moderate learning disabilities: an exploratory study', *Journal of Intellectual Disabilities* 5: 267-280.

Paxton, D., McKenzie, K. and Murray, G. 2008 'Putting screening tools to the test', *Learning Disability Practice* 11 (8): 14-18.

Proctor, T. and Beail, N. 2007 'Empathy and theory of mind in offenders with intellectual disability', *Journal of Intellectual and Developmental Disability* 32 (2): 82-93.

Reiss, S., and Rojahn, J. 1993 'Joint occurrence of depression and aggression in children and adults with mental retardation', *Journal of Intellectual Disability Research* 37: 287-294.

Rojahn, J., Kroeger, T.L. and McElwain, D.C. 1995 'Performance on the Penn Facial Discrimination Task by adults with mental retardation', *American Journal on Mental Retardation* 99: 316-319.

Rojahn, J., Lederer, M. and Tassé, M. J. 1995 'Facial emotion recognition by persons with mental retardation: A review of the experimental literature', *Research in Developmental Disabilities* 16 (5): 393-414.

Rojahn, J., Rabold, D. E. and Schneider, F. 1995 'Emotion specificity in mental retardation', *American Journal on Mental Retardation* 99 (5): 477-486.

Rojahn, J. and Warren, V. J. 1997 'Emotion recognition as a function of social competence and depressed mood in individuals with intellectual disability', *Journal of Intellectual Disability Research* 41 (6): 469-475.

Sogon, S. and Izard, C.E. 1985 'Ability to recognise emotion in normal and mentally retarded Japanese children', *Japanese Psychological Research* 27: 125-132.

Weisman, J. and Brosgole, L. 1994 'Facial affect recognition in singly diagnosed mentally retarded people and normal young children: A methodological comparison', *International Journal of Neuroscience* 75 (1-2): 45-55.

Williams, K.R., Wishart, J.G., Pitcairn, T.K. and Willis, D.S. 2005 'Emotion recognition by children with Down syndrome: an investigation of specific impairments and error patterns', *American Journal on Mental Retardation* 110: 378-392.

Wishart, J.G., Cebula, K.R., Willis, D.D. and Pitcairn, T.K. 2007 'Understanding of facial expressions of emotion by children with intellectual disabilities of varying aetiology', *Journal of Intellectual Disability Research* 51: 551-563.

Woodcock, K. A. and Rose, J. 2007 'The relationship between the recognition of facial expressions and self-reported anger in people with intellectual disabilities', *Journal of Applied Research in Intellectual Disabilities* 20 (3): 279-284.

Zaja, R. H. and Rojahn, J. 2008 'Facial emotion recognition in intellectual disabilities', *Current Opinion in Psychiatry* 21 (5): 441-444.

### **Journal Article 3: Secondary Empirical Study**

Title:

Global-local processing and emotion recognition: do adults with a learning disability differ from adults and children without learning disability?

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Prepared in accordance with guidelines for submission to *Learning Disability Practice* (Appendix 14)

## **Abstract/Summary**

People with a learning disability are known to have difficulty with recognising facial expressions of emotion. Studies of people with autism suggest that they may differ from controls in terms of cognitive processing style. No studies to date have directly examined the cognitive processing style of people with a learning disability and any possible link to emotion recognition. Evidence from the present study suggests that adults with learning disability tend to adopt a more ‘local’ processing style, compared with adults and children without learning disability. Given that a more ‘global’ processing style was associated with better performance on tasks of facial emotion recognition, it is tentatively proposed that people with a learning disability may be more inclined to process information in a more detailed focussed way, and this may account, in part, for the observed impairments in facial emotion recognition.

## Introduction

There is a growing body of research to suggest that people with learning disability of unknown aetiology (i.e. excluding those with co-morbid diagnoses such as autism spectrum disorder, Down syndrome, Fragile X syndrome etc.) are impaired in the ability to recognise and interpret facial expressions of emotion (e.g. Moore, 2001; Rojahn et al., 1995; Owen et al., 2001). There is conflicting evidence to suggest *why* this impairment might exist in people with a learning disability. Rojahn et al., (1995) proposed the emotion specificity hypothesis; that is they suggested that impaired emotion recognition capabilities in people with learning disability cannot be explained by cognitive-intellectual limitations alone and instead impairment is the result of a *specific* impairment in emotion recognition competence. Conversely, Moore (2001) evaluated evidence from a number of studies in this area and proposed that impaired emotion recognition in people with a learning disability is the result of impaired information-processing capacities, rather than reflecting a specific deficit related to decoding emotions.

A number of studies have examined the ability of people with specific syndromes related to learning disability to recognise and interpret facial expressions of emotion. The emotion recognition capabilities of people with autism spectrum disorder (ASD) have been given the greatest research attention in this area. The majority of studies have found that people with ASD demonstrated significant impairment in facial emotion recognition, when compared with typically developing individuals and with other clinical groups (e.g. Bormann-Kischkel et al., 1995; Feldman et al., 1993). However a review of the research in this area highlighted inconsistent findings, with some evidence found to suggest that facial emotion recognition is intact in people with ASD (Harms et al., 2010).

Some studies have provided evidence to suggest that the information processing style of the individual may have an impact on the ability to recognise facial expressions of emotion (e.g. Fallshore & Bartholow, 2003). This research has been predominantly confined to people with ASD. Some evidence has suggested that people with ASD

may perceive visual information differently to people without ASD. For example, studies have shown that, when asked to make judgements about facial identity, people with ASD were less likely to perceive faces as organised wholes (e.g. Joseph & Tanaka, 2003). Similar findings have been reported from studies in which participants with ASD were asked to make judgements about emotional expression (e.g. Gross, 2004; Klin et al., 2002). Overall, research appears to suggest that people with ASD were more likely to employ a processing approach that focused on the details, or 'local' features of visual information, rather than the 'gist' or 'global' features, a phenomenon referred to as 'weak central coherence' (e.g. Frith & Happé, 1994; Happé & Frith, 2006). Successful processing of and interpreting of facial emotional expressions is hypothesised to require a more 'global' approach to processing information and this may therefore explain the observed emotion recognition impairments in people with ASD (Behrman et al., 2006). However, limited research has explored processing style and its relationship to emotion recognition capabilities in people with learning disability without autism. This is despite the increasing interest in developing interventions to improve emotion recognition in people with learning disability.

### *Aims*

The present study therefore aims to examine whether there are any differences in the cognitive processing style, as measured by global-local processing tasks, of adults with a learning disability compared with chronological age and 'mental age' matched control participants. A further aim is to examine whether cognitive processing style is related to the ability to recognise facial expressions of emotion.

### *Hypotheses*

In relation to the above-described aims, the following hypotheses are made:

1. Adults with a learning disability will differ from control participants in terms of the frequency with which they select global, local or unrelated response alternatives on a measure of cognitive processing style.

2. There will be a relationship between cognitive processing style (as measured by a global-local processing task) and emotion recognition.
3. There will be a relationship between cognitive processing style and performance on non-emotion control tasks.

## Methodology

Three groups of participants were recruited, as part of a wider study of the emotion recognition capabilities of people with a learning disability. The three groups comprised:

- (i) adults with a learning disability (LD, n = 23; 18 male, 5 female)
- (ii) a control group of children who were recruited as a ‘mental age’ matched control group (‘child control group’, n = 23; 11 male, 12 female)
- (iii) a control group of adult participants who did not differ significantly from the intellectual disability group with respect to age and sex (‘adult control group’, n = 23).

The demographic characteristics of participants and a detailed account of recruitment procedures and materials used are described elsewhere (Scotland, 2014, unpublished doctoral thesis, University of Edinburgh).

### *Measures*

#### Emotion recognition and control task measures

All participants were administered an updated version of the ‘Feelings and Emotions’ assessment used in the studies by McKenzie et al., (2001). These tasks involved naming and identifying target emotions presented in line drawings and in photographs with and without contextual information available.

Participants also completed control tasks. These tasks were parallel versions of the emotion recognition tasks that did not involve any emotion recognition component. Instead, participants were asked to name or identify the hair or eye colour of line drawings and photographs with and without detail. The inclusion of control tasks allows exploration of whether there is a differential effect of processing style on emotion versus non-emotion tasks.

### Cognitive processing style

In order to determine cognitive processing style, all participants were asked to complete a series of global-local processing tasks.

Participants were shown a target picture (e.g. a heart shape made from flowers) and were then asked to decide which picture, from a choice of three options was the most similar to the target picture. The three options for each target picture were an unrelated picture (e.g. a watering can), a picture that reflects a global processing style (e.g. a heart shape) and a picture that reflects a local processing style (e.g. a bunch of roses). Six targets images were presented in total and participants were asked to voice their response or to point to their desired response for each item.

## Results

### *Emotion recognition tasks*

Detailed analysis of the emotion recognition task performance between the three groups is described elsewhere (Scotland, 2014, unpublished doctoral thesis, University of Edinburgh) and are described, in brief, as follows:

The group of participants with a learning disability had a mean (SD) overall score of 49.8 (11.5) on the emotion tasks. The adult control group had a mean overall score of 72.1 (4.4) and the child control group had a mean overall score of 66.7 (3.9) on the emotion tasks.

In order to compare the relative overall performance of the three groups on the emotion recognition tasks, a one-way ANOVA was carried out. Group was the independent factor and the overall score on the emotion recognition tasks was the dependent variable. This analysis showed that the three groups differed significantly on the emotion recognition tasks,  $F(2,65) = 55.22$ ,  $p < 0.001$ . Post-hoc tests showed that the learning disability group performed significantly less well than both the adult and child control groups ( $P < 0.001$ ,  $d = -2.56$  and  $p < 0.001$ ,  $d = -1.97$ , respectively).

### *Hypothesis 1. Global-Local task responses*

The mean (SD) frequencies with which participants in each group selected global items, local items and unrelated items in the response sets are shown in Table 1.

Three one-way ANOVAs were carried out for each of the global, local and unrelated response data, with group as a between-subjects factor.

#### Global Item Responses

A significant main effect of participant group was obtained in the analysis of the frequency with which participants selected the global item in the response set,  $F(2,65) = 12.914$ ,  $p < 0.001$ . Post-hoc analyses, using Bonferroni tests revealed that

the learning disability group made significantly fewer global responses than the child control group ( $p = 0.002$ ) and the adult control group ( $p < 0.001$ ). The child control group and the adult control group did not differ significantly ( $p = 0.576$ ).

#### Local Item Responses

A significant main effect of participant group was found in the model of the frequency with which participants selected the local item in the response set,  $F(2,65) = 5.913$ ,  $p = 0.004$ . Post-hoc analyses, using Bonferonni tests revealed that the learning disability group made significantly more local responses than the adult control group, ( $p = 0.004$ ) but did not differ significantly from the child control group, ( $p = 0.106$ ). The adult and child control groups did not differ significantly, ( $p = 0.696$ ).

#### Unrelated Item Responses

There was a significant main effect of participant group in the model of the frequency with which participants selected the unrelated item in the response set,  $F(2,65) = 6.271$ ,  $p = 0.003$ . Post-hoc tests indicated that the learning disability group made significantly more unrelated responses than both the child control group ( $p = 0.010$ ) and the adult control group ( $p = 0.10$ ). No participants in the adult or child control groups selected the unrelated item response on any occasion and, therefore, the two control groups did not differ significantly ( $p = 1.00$ ).

Table 1. Mean scores and standard deviations for the frequency with which each participant group selected each option in the response set (global, local or unrelated item).

		Global-local processing task		
		Global	Local	Unrelated
		Mean (SD)	Mean (SD)	Mean (SD)
	All participants combined	3.16 (2.00)	2.63 (2.00)	0.21 (0.72)
Participant Group	Learning Disability	1.74 (1.36)	3.65 (1.87)	0.61 (1.16)
	Child Control	3.55 (1.74)	2.45 (1.74)	0.00 (0.00)
	Adult Control	4.22 (1.98)	1.78 (1.98)	0.00 (0.00)

*Hypothesis 2. Relationship between Emotion Recognition and Global-Local Task responses*

Correlation coefficients were calculated between the whole sample's performance on the global-local task and their overall performance on the emotion recognition tasks. Exploration of the data revealed that the global-local task scores were not normally distributed, therefore non-parametric correlations were used. Kendall's tau,  $\tau$ , was selected, rather than Spearman's rho, as it is a better estimate of the correlation in the population and more accurate generalisations can be drawn (Field, 2012; Howell, 2013).

The frequency with which all participants selected the global, local and unrelated response alternatives was correlated with total overall scores on the emotion recognition tasks. These correlations are shown in Table 2.

There was a significant, positive relationship between the selection of the global response alternative and performance on the emotion recognition tasks, for all participant groups combined. Participants who selected the global response alternative more frequently had higher overall scores on the emotion recognition tasks. The association between frequency of selection of the local response item and overall emotion recognition task score did not reach significance ( $p = 0.072$ ). There was a significant, negative relationship between selection of the unrelated response item and overall emotion recognition task score ( $p < 0.001$ ), suggesting that participants who selected the unrelated response more frequently performed less well on the emotion recognition tasks.

Table 2. Overview of correlations between the frequency with which each option in the response set was selected (global, local or unrelated item) and overall score on the emotion recognition and control tasks.

	Global-local processing task					
	Global		Local		Unrelated	
	Correlation co-efficient	p-value for significance	Correlation co-efficient	p-value for significance	Correlation co-efficient	p-value for significance
Emotion recognition tasks	0.272	0.003	-0.162	0.072 (ns)	-0.357	< 0.001
Control tasks	0.172	0.077 (ns)	-0.036	0.711	-0.464	< 0.001

*Hypothesis 3. Relationship between performance on Control tasks and Global-Local Task responses*

The following analyses were carried out in order to test the hypothesis that there would be a relationship between processing style and performance on control tasks without any emotion component.

Correlation coefficients were calculated between global-local task performance and overall performance on the control tasks for the whole sample, as described above. These correlations are shown in Table 2.

There was no significant relationship between the frequency with which global or local responses were made and overall performance on control tasks for the sample as a whole. Participants who selected the ‘unrelated’ response more frequently performed less well on the control tasks ( $p < 0.001$ ).

## Discussion

The present study found that adults with a learning disability differed from control participants in terms of cognitive processing style, as measured by a global-local processing task. Specifically, adults with a learning disability were more likely to engage in 'local' processing when compared with adults without learning disability and were less likely to engage in 'global' processing than both adults and children without learning disability. Adults with a learning disability also performed significantly less well on emotion recognition tasks than both the chronological and mental age matched control groups.

For the sample as a whole, a more global information processing style was associated with greater accuracy in recognising facial expressions of emotion. On the control tasks that had no emotion recognition component, only a greater frequency of selection of 'unrelated' item responses was related to poorer performance.

To date, no studies have directly evaluated the cognitive processing style of people with a learning disability and its potential impact on emotion recognition capabilities. The results of the present, preliminary study may go some way towards explaining why people with learning disability demonstrate relative impairment in emotion recognition, when compared with non-learning disabled counterparts. There is evidence to suggest that facial expressions of emotion are more easily recognised when faces are perceived as organised wholes as this form of processing tends to provide a richer and less ambiguous source of information than a more focussed (i.e. local) processing style (e.g. Gross, 2005; Smith & Scott, 1998). Therefore, given that adults with a learning disability in this sample were more likely to engage in 'local' processing, this might account for their poorer performance on the emotion recognition tasks.

Previous studies in this area have tended to focus on examining the perceptual abilities of people with autism, in particular with regard to facial perception. Studies have generally reported that people with autism are less inclined to regard faces as

organised wholes when making judgements about identity (e.g. Joseph & Tanaka, 2003; Rondan et al., 2003) and when identifying emotional expression (e.g. Gross, 2004; Klin et al., 2002). Gross (2005) compared the ability of children with and without autism to recognise facial age and emotional expressions with their performance on a global-local processing task. Gross (2005) found that adoption of a more 'global' processing style was significantly correlated with the ability to make judgements about age and emotions for both human and canine stimuli. Thus, the results of the present study suggest that relationship between a more local processing style and impaired facial perception that has been found to be present in people with autism may also be evident in people with learning disabilities, more generally.

Limitations of the present study must be addressed. Firstly, the above-described analyses were based on relatively small sample sizes. Male participants were over-represented in the learning disability group. Given that there is some evidence to suggest that males and females might differ on tasks that involve making perceptual judgements, a more representative sample would have been preferred (Kramer et al., 1996; Roalf et al., 2006). Furthermore, that the learning disability group were significantly more likely to choose the 'unrelated' task response on the global-local processing task than were participants in both control groups might suggest a lack of understanding of the task instructions for a greater proportion of participants with a learning disability. Therefore, the answers given by some participants in this group might not accurately reflect the way in which they process visual information, but rather could reflect poor verbal comprehension. Gross (2005) presented four 'training trials' to participants, prior to administering the six main task trails. These training trials were parallel versions of the main global-local tasks test trails, but included only one related image and two unrelated images. Participants were required to make the correct response on the last two training trials in order to progress to completing the main global-local task trails. Inclusion of a similar methodology in the present study would have enhanced the validity of the findings.

The findings of the present study do not provide any evidence for the *specificity* of emotion recognition impairments in people with a learning disability (i.e. for the

emotion specificity hypothesis, Rojahn et al., 1995) but instead suggest that differences in cognitive processing style, more generally could account for observed impairments. Thus, support is given to the proposal made by Moore (2001): that impaired emotion recognition in people with learning disability reflects limitations in information processing in people with learning disability. The control task used in the present study perhaps lends itself to a more local, detail-focussed processing style, i.e. making judgements about eye and hair colour. However, inclusion of an alternative control task in which a more global cognitive processing style is beneficial, e.g. making judgements about facial age, would allow further evaluation of the specificity of emotion recognition impairment and its relationship to cognitive processing style.

The findings of this study have implications in terms of informing the methodology of future interventions designed to improve the emotion recognition skills of people with learning disability. For example, it is possible to prime participants to use either global or local processing to respond to stimuli (Navon, 1977). Priming, or cueing participants to respond in a specific way has been shown to enhance accuracy in facial recognition, when the response elicited matches the precedence of the image (Perfect et al., 2008). If future research confirms a local processing bias is common to this group, priming people with learning disability to process faces in a more global way may encourage them to be more cognitively flexible and may therefore improve their ability to recognise and interpret facial expressions of emotion.

Impaired emotion recognition has been shown to be associated with a number of potential, negative outcomes. Potential consequences include an increased frequency of antisocial behaviour, breakdown of placements and increased incidence of emotional disturbance (e.g. Rojahn et al., 1995; Zaja & Rojahn, 2008). Therefore, establishing the factors associated with this impairment is important in order to help us to devise effective and targeted interventions with the aim of improving this fundamental skill.

## References

Behrmann, M., Thomas, C. and Humphreys, K. 2006 'Seeing it differently: visual processing in autism', *Trends in Cognitive Sciences* 10 (6): 258-264.

Bormann-Kischkel., C., Vilsmeier, M. and Baude, B. 1995 'The development of emotional concepts in autism', *Journal of Child Psychology and Psychiatry and Allied Disciplines* 36 (7): 1243-1259.

Fallshore, M. and Bartholow, J. 2003 'Recognition of emotion from inverted schematic drawings of faces', *Perceptual and Motor Skills* 96: 236-244.

Feldman, R.S., McGee, G.G., Mann, L. and Strain, P. 1993 'Nonverbal affective decoding ability in children with autism and in typical preschoolers', *Journal of Early Intervention* 17 (4): 341-350.

Field, A. 2012 *Discovering Statistics Using IBM SPSS Statistics. 4<sup>th</sup> Edition.* London: Sage.

Frith, U. and Happé, F. 1994 'Autism: beyond "theory of mind"', *Cognition* 50: 115-132.

Gross, T.F. 2004 'The perception of four basic emotions in human and nonhuman faces by children with autism and other developmental disabilities', *Journal of Abnormal Child Psychology* 32: 469-480.

Gross, T.F. 2005 'Global-local precedence in the perception of facial age and emotional expression by children with autism and other developmental disabilities', *Journal of Autism and Developmental Disorders* 35 (6): 773-785.

Happé, F. and Frith, U. 2006 'The weak coherence account: detail-focused cognitive style in autism spectrum disorders' *Journal of Autism and Developmental Disorders* 36 (1): 5-25.

Harms, M.B., Martin, A. and Wallace, G.L. 2010 'Facial emotion recognition in autism spectrum disorders: a review of behavioral and neuroimaging studies', *Neuropsychology Review* 20: 290-322.

Howell, D.C. 2013 *Statistical Methods for Psychology, Eight Edition*. Wasdworth: USA.

Joseph, R.M. and Tanaka, J. 2003 'Holistic and part-based face recognition in children with autism', *Journal of Child Psychology and Psychiatry and Allied Disciplines* 44: 529-542.

Klin, A., Jones, W., Schultz, R., Volkmar, F. and Cohen, D. 2002 'Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism', *Archives of General Psychology* 59: 809-816.

Kramer, J.H., Ellenberg, L., Leonard, J. and Share, L. 1996 'Developmental sex differences in global-local perceptual bias', *Neuropsychology* 20 (3): 402-407. doi: 10.1037/0894-4105.10.3.402.

McKenzie, K., Matheson, E., McKaskie, K., Hamilton, L. and Murray, G.C. 2001 'A picture of happiness', *Learning Disability Practice* 4 (1): 26-29.

Moore, D. G. 2001 'Reassessing emotion recognition performance in people with mental retardation: A review', *American Journal on Mental Retardation* 106 (6): 481-502.

- Navon, D. 1977 'Forest before trees: the precedence of global features in visual perception'. *Cognitive Psychology* 9: 353-383.
- Owen, A., Browning, M. and Jones, R.S.P. 2001 'Emotion recognition in adults with mild-moderate learning disabilities: an exploratory study', *Journal of Intellectual Disabilities* 5: 267-280.
- Perfect, T.J., Weston, N.J., Dennis, I and Snell, A. 2008 'The effects of precedence on Navon-induced processing bias in face recognition', *The Quarterly Journal of Experimental Psychology* 61 (10): 1479–1486. doi:10.1080/17470210802034678.
- Roalf, D., Lowery, N. and Turetsky, B.I. 2006 'Behavioral and physiological findings of gender differences in global-local visual processing', *Brain and Cognition* 60 (1): 32-42.
- Rojahn, J., Lederer, M., and Tassé, M. J. 1995 'Facial emotion recognition by persons with mental retardation: A review of the experimental literature', *Research in Developmental Disabilities* 16 (5): 393-414.
- Rojahn, J., Rabold, D. E., and Schneider, F. 1995 'Emotion specificity in mental retardation', *American Journal of Mental Retardation* 99 (5): 477-486.
- Rondan, C., Gepner, B. and Deruelle, C. 2003 'Inner and outer face perception in children with autism', *Child Neuropsychology* 9: 289-297.
- Smith, C.A. and Scott, H.S. 1998 'A componential approach to the meaning of facial expression', in J.A. Russell and J.M. Fernandez-Dols (eds) *The psychology of facial expression*. NY: Cambridge University Press.
- Zaja, R. H. and Rojahn, J. 2008 'Facial emotion recognition in intellectual disabilities', *Current Opinion in Psychiatry* 21 (5): 441-444.

## **Appendices**

### Appendix 1. Guidelines for authors for submission to *Research in Developmental Disabilities*

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### **Introduction**

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

### **Material and methods**

Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described.

### **Theory/calculation**

A Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

### **Results**

Results should be clear and concise.

### **Discussion**

This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

### **Conclusions**

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

### **Appendices**

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

### **Essential title page information**

- **Title.** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- **Author names and affiliations.** Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
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### **Abstract**

A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

### **Graphical abstract**

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### Acknowledgements

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Present simple formulae in the line of normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).

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Reference to a chapter in an edited book:

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## Appendix 2. Systematic Review Protocol

### **Systematic Review Protocol (March 2014)**

**Revised July 2014**

*Based on York University's Centre for Reviews and Dissemination Guidance for undertaking reviews in healthcare (CRD, 2009)*

#### **Background**

- People with a learning disability are generally accepted to have difficulty in emotion recognition.
- Different theories for why this is – due to cognitive-intellectual limitations vs emotion specificity hypothesis.
- Studies often look at specific groups of people with LD (e.g. ASD, Down's Syndrome) and/or lack appropriate control tasks or groups.

#### *Previous reviews*

- (Rojahn, Lederer & Tasse, 1995) - people with a learning disability have difficulties recognising expressed emotions compared with normally developing individuals.
- Emotion recognition ability decreases with declining levels of cognitive function
- Preliminary evidence that deficits in recognition of visual affective information cannot be fully accounted for by cognitive-intellectual limitations ('mental age'; Emotion Specificity Hypothesis (ESH)).
- Zaja & Rojahn (2008) - 'review' of recent emotion recognition research in LD population – not systematic, no transparent search strategy, no scoring framework for rating the methodological quality of studies.
- Moore (2001) – review of emotion recognition performance in people with 'mental retardation', looks at relationship between task performance, emotion recognition capacities and IQ.

No systematic reviews detailing search strategies or with scoring framework for rating methodological quality.

#### **Review Question(s)**

Objective: What evidence is there that adults with a learning disability show impairment in recognising facial expressions of emotion, compared with the non-learning disabled population?

#### **Inclusion/exclusion criteria**

- Full-text available
- Article available in English
- All publication dates

### *Population*

Studies involving adults ( $\geq 18$  years) who are described as having a learning disability (or equivalent term). Studies of specific groups of people with LD (e.g. ASD, Down Syndrome etc.) not included.

### *Intervention or Exposure*

Emotion recognition tasks used involve still, photo based images (including drawings)

### *Comparators*

Study includes at least one control group of participants without a learning disability.

### *Outcomes*

Quantitatively evaluates responses to any task(s) that require(s) identification of facial expressions of emotions.

### *Study Design*

Controlled study

All types of study design, excluding single case studies

## **Identifying research evidence:**

### **Planned search strategy**

- **Terms:** learning disab\*, intellectual disab\*, mental retardation, developmental disab\*, learning disorder, mental handicap, intellectual impairment AND 'emotion recognition', 'affect recognition', facial expression'
- **Databases:** (MEDLINE, EMBASE, Cochrane Register of Controlled Trials (CENTRAL), PsycINFO, CINAHL) using the following search terms as free text or subject headings as appropriate for each database: learning disab\*, intellectual disab\*, mental retardation, developmental disab\*, learning disorder, mental handicap, intellectual impairment in combination with 'emotion recognition', 'affect recognition', facial expression'
- Manual search of reference lists of papers selected for review
- Manual search of reference lists for previous reviews

### **Study selection**

1. Screen titles for relevance
2. If relevant title, screen abstract to establish whether study meets eligibility criteria
3. Review full-text of retained studies to establish whether study meets eligibility criteria
4. Final selection of studies included

### **Data Extraction**

Information to be extracted from studies included in the review (based on quality criteria):

- Research question
- Study design
- Population(s)
- Measures
- Main findings
- Limitations

### **Quality Assessment**

- Devise quality criteria
- Each criteria domain scored as follows: ‘well-covered’, ‘adequately addressed’, ‘poorly addressed’, ‘not addressed’, ‘not reported’ or ‘not applicable’. (SIGN ratings). Specific definitions for each score within each domain.

### **Data synthesis**

- Narrative
- Summary of individual study findings and characteristics (from data extraction form)
- Overall rating and quality ratings for each of the dimensions identified.
- Overall summary of state of literature in this area
- Identification of limitations of available literature
- Areas for future research identified.

### **Dissemination**

- Chapter in doctoral portfolio thesis
- Submit for publication

### Appendix 3. Operationalisation of quality criteria

#### 1. The study addresses a clearly focussed question, drawn from a theoretical model, or previous research

Well covered	Aims of study are clearly stated and link to previous research or theoretical stance is clearly described.
Adequately addressed	Aims of study are less clearly described or may be somewhat unclear. Some links to previous research or theoretical underpinnings are described.
Poorly addressed	Aims of study are not stated and rationale for the research is unclear.

#### 2. Sampling: The characteristics of the participants are representative of the group being studied

Well covered	Range of IQ scores of participants is described and does not include participants in the 'borderline' level of functioning (i.e. all participants have IQ scores < 70). Recruitment method is such that participants are identified from a number of different sources (i.e. not a single day centre, hospital etc.).
Adequately addressed	Range of IQ scores of participants is reported and may include a small number of participants whose level of ability falls outwith the range of learning disability and within the 'borderline' level of functioning. If participants are recruited from a single source (i.e. day centres etc.), this source is likely to include a wide range of people with an LD.
Poorly addressed	Participants IQ scores fall widely outwith the range of learning disability and/or source of recruitment is likely to result in significant bias (e.g. from specialist mental health service, service for people with a specific diagnosis such as ASD, Down Syndrome etc.).

#### 3. Inclusion/exclusion criteria are reported and are appropriate in order to avoid confounds or bias.

Well covered	Inclusion/exclusion criteria are explicitly stated and detail is given. Variables that are known to impact on emotion recognition abilities are identified as exclusion criteria (e.g. ASD, dementia, schizophrenia)
Adequately addressed	Some key variables known to affect emotion recognition are identified as exclusion criteria.
Poorly addressed	No inclusion/exclusion criteria described OR inclusion/exclusion criteria described do not address relevant variables described above.

**4. Participants: Detail is given about the criteria used to diagnose learning disability**

Well covered	All participants had previously been administered an appropriate valid and reliable measure of IQ (e.g. WAIS) and assessment of adaptive functioning and age of onset was also considered in diagnosing learning disability.
Adequately addressed	Participants had completed an appropriate valid and reliable measure of IQ (e.g. WAIS) but no information is given regarding adaptive functioning or age of onset.
Poorly addressed	Little or no information is given about the measures used to diagnose learning disability.

**5. The study has an adequate control group**

Well covered	The study has a chronological age matched control group and a 'mental age' matched (child) control group.
Adequately addressed	The study has either a chronological age matched control group or a 'mental age' matched (child) control group.
Poorly addressed	The control group does not include participants from the general, non-learning disabled population.

**6. The emotion recognition measure used is reliable, valid and standardised**

Well covered	Psychometric properties of measure demonstrate high validity and reliability. The measure is standardised and has previously been used in other studies including people with learning disabilities.
Adequately addressed	Psychometric properties of measure are acceptable and validity and reliability are adequate. The measure is less standardised and less commonly used with people with learning disabilities.
Poorly addressed	Psychometric properties of measure have low validity and reliability OR non-standardised measure with no established psychometric properties.

**7. A control task is used**

Well covered	A control task with equivalent demands to that of the emotion recognition tasks is used and the psychometric properties of the task are reported and are acceptable.
Adequately addressed	A control task is used but may not have similar demands as the emotion recognition task or psychometric properties of the task are not reported.
Poorly addressed	No control task is used.

**8. Inter-rater reliability is addressed**

Well covered	Two or more raters used for a significant proportion of data gathered and high levels of inter-rater agreement; detail given regarding steps taken to address disagreement between raters.
Adequately addressed	Two or more raters used for a smaller proportion of data gathered and levels of agreement less consistent, or less detail given regarding how disagreement was addressed.
Poorly addressed	No second rater used for any aspect of data gathering.

**9. Sample size and power are adequate**

Well covered	Power calculation undertaken and reported using reasonable estimation of effect size and subsequent sample size sufficient.
Adequately addressed	Sample size adequate for statistical power but no calculation undertaken/reported or estimation of effect size not based on previous research.
Poorly addressed	Insufficient sample size and low power to detect statistically significant difference.

**10. Appropriate analyses are carried out and confidence intervals, effects sizes and p-values are reported, where appropriate**

Well covered	Appropriate quantitative analyses carried out and p-values, effect sizes and confidence intervals reported.
Adequately addressed	Appropriate quantitative analyses carried out but p-values, effect sizes and confidence intervals less fully described.
Poorly addressed	Poor or inappropriate method of statistical analyses carried out.

Appendix 4. Summary of Quality Assessment

<b>Quality Criteria</b> <b>Study</b>	<b>1. Research Question</b>	<b>2. Sampling</b>	<b>3. Inclusion/ Exclusion Criteria</b>	<b>4. LD Diagnosis</b>	<b>5 Control Group</b>	<b>6 Emotion recognition measure</b>	<b>7. Control Task</b>	<b>8. Inter-rater reliability</b>	<b>9. Sample size/ power</b>	<b>10. Analysis</b>	<b>Overall Rating*</b>
Pang-Leung & Singh (1998)	Well	Adequate	Not reported	Poor	Adequate	Well	Poor	Well	Adequate	Adequate	+
Rojahn, Rabold & Schneider (1995)	Well	Adequate	Well	Adequate	Well	Well	Adequate	Poor	Poor	Adequate	++
Weisman & Brosgole (1994)	Well	Well	Adequate	Adequate	Adequate	Poor	Poor	Poor	Poor	Adequate	0
Harwood, Hall & Shinkfield (1999)	Well	Adequate	Poor	Adequate	Adequate	Adequate	Adequate	Poor	Poor	Adequate	+
McAlpine, Singh, Kendall & Ellis (1992)	Well	Adequate	Poor	Poor	Adequate	Well	Poor	Poor	Adequate	Adequate	+
Maurer & Newbrough (1987)	Well	Adequate	Poor	Poor	Adequate	Poor	Poor	Poor	Poor	Adequate	0
McAlpine, Kendall & Singh (1991)	Adequate	Adequate	Poor	Poor	Adequate	Well	Poor	Adequate	Adequate	Adequate	+
Owen, Browning & Jones (2001)	Well	Adequate	Adequate	Adequate	Adequate	Adequate	Poor	Poor	Poor	Adequate	+
McKenzie, Matheson, McKaskie et al. (2001)	Well	Adequate	Poor	Poor	Adequate	Adequate	Poor	Poor	Adequate	Adequate	+

\*Overall rating assigned to each study as follows (SIGN, 2012):

++ = *High quality*: majority of criteria met. Little or no risk of bias. Results unlikely to be changed by further research.

+ = *Acceptable*: most criteria met. Some flaws in the study with an associated risk of bias. Conclusions may change in light of further evidence.

0 = *Low quality*: either most criteria not met or significant flaws relating to key aspects of study design. Conclusions likely to change in light of further studies.

Quality Criteria

1. The study addresses a clearly focussed question, drawn from a theoretical model or previous research
2. Sampling: the characteristics of the participants are representative of the group being studied
3. Inclusion/exclusion criteria are reported and are appropriate in order to avoid confounds or bias
4. Participants: detail is given about the criteria used to diagnose learning disability
5. The study has an adequate control group
6. The emotion recognition measure used is reliable, valid and standardised
7. A control task is used
8. Inter-rater reliability is addressed
9. Sample size and power are adequate
10. Appropriate analyses are carried out and confidence intervals, effect sizes and p- values are reported, where appropriate.

## Appendix 5. Author guidelines for submission to the journal *International Journal of Developmental Disabilities*

### Journal information

#### ***International Journal of Developmental Disabilities***

**Editor: Dr Brian Salmons**

**Editor: Prof Arturo Langa**

#### **Aims & scope**

The *IJDD* publishes scientific articles on work dealing with different approaches to the habilitation problems of people with an intellectual disability. The journal covers the entire spectrum of intellectual disabilities, and is concerned with definitions, IQ, genetic predisposition, evaluation of abilities, learning interventions, challenging behaviour, medication, attitudes to death and bereavement, sexuality, legal aspects, WHO, NICE and other governmental guidelines, care in the community, advocacy, stress and coping strategies for families and carers - though this is not an exhaustive list. The unifying theme is that all of these aspects should be of practical help for those with intellectual disabilities or those caring for persons with intellectual disabilities. Emphasis is placed on the practical implications of the work of educationists, instructors, nurses, occupational and other therapists, psychiatrists, psychologists and social workers, whether taking place in a hospital setting or in community care.

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- **Original research papers** should usually be a maximum of 7,000 words. Authors intending to submit longer papers should contact the Editor. Papers should be divided into the following sections: Introduction; Methods; Results; Discussion.
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- **Letters to the Editor**
- **Commentary**
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- figures

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Rance, G. and Dowell, R.C. 1997 'Speech processor programming', in G. M. Clark, R. S. C. Cowan and R. C. Dowell (eds) *Cochlear Implantation for Infants and Children – Advances*, pp. 147-170. San Diego: Singular.

### E-Journal

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### Participant Information Sheet

You are invited to take part in a research study.



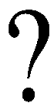
Please read this information sheet to help you to decide if you would like to take part. You can ask your support worker or a member of staff to help you.

My name is Jen Scotland. I am training to be a Clinical Psychologist.

As part of my training, I am doing a research study.

I want to find out how well different groups of people can recognise different emotions.

#### **Why have I been asked to take part?**



You have been asked to take part because you get help from a Community Learning Disability Team.

#### **Do I have to take part?**

No. You can decide if you want to take part.



You **do not** have to take part if you do not want to.



#### **What will happen if I want to take part?**

If you want to take part, I will contact you and arrange to meet with you. We can meet somewhere that suits you. It might be your home, a day centre, GP practice or a clinic.

You can bring your support worker, or someone you trust.

When we meet, I will answer any questions you have and you will be asked to sign a form to say you agree to take part.



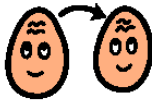
I will show you some different pictures on a computer screen. You will be asked some questions about the pictures.  
I will meet with you for about 30 minutes.



I will write to your GP and/or to the Learning Disability Team to let them know you took part in my research study.

### **What are the benefits of taking part?**

There are no benefits to you if you take part.  
Information from the research might help us to work better with people with learning disabilities in the future.



### **What if I change my mind about taking part?**

You can change your mind or stop the tasks at any time.

### **What will happen to the answers I give?**



Your answers to the questions will be stored on a computer. This information will be anonymised. This means that it will not have your name or any other personal information on it, so no-one else will know that the answers are yours.



I will write about the study. I will not mention your name or anything else about you or anyone else who takes part in the study.



If you have any questions you can phone me

**0131 537 6270**

If you would like to speak to someone who is not part of this study, you can contact Dr Ethel Quayle on 0131 651 3972.



If you would like to make a complaint about the study please contact NHS

Lothian:

NHS Lothian Complaints Team

2<sup>nd</sup> Floor

Waverley Gate

2-4 Waterloo Place

Edinburgh

EH1 3EG

**Thank you for reading this.**

**Emotion recognition and people with a learning disability**  
**A research study**

**Consent Form**

**Please read each statement carefully and write your initials in the box if you agree with it.**



**I have read and understood the information sheet and have had the chance to ask questions.**



**I understand that I do not have to take part and I can change my mind at any time without giving a reason.**



**I am happy for you to write to my GP and/or the Community Learning Disability Team to let them know that I have taken part.**



**I agree that my data can be used in other research studies that have been ethically approved. This means that people have checked the research is safe.**



**I understand that responsible people might look at my medical notes and data from the study. I am happy for these people to have access to my data and records.**



**I agree to take part in the study.**

\_\_\_\_\_  
**Name of participant**

\_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Name of person taking consent**

\_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Witness**

\_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Date**



**Emotion recognition and people with a learning disability**

**Participant Information Sheet**

You are being asked to take part in a research study.



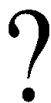
Please read this information sheet to help you to decide if you would like to take part.

My name is Jen Scotland. I am training to be a Clinical Psychologist.

As part of my training, I am doing a research study.

I want to find out how well different groups of people can recognise different emotions.

**Why have I been asked to take part?**



You have been asked to take part because you are aged between 5 and 17 and attend a school that is taking part in the study.

**Do I have to take part?**



No. You can decide if you want to take part. You **do not** have to take part if you do not want to. Your parent has also been given some information about the study. You can discuss the study with them. If you decide not to take part, you or your parent/carer can let your teacher know.

**What will happen if I want to take part?**

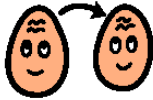


You will be shown some different pictures on a screen. You will be asked some questions about the pictures. The researcher will either visit you at school to complete the tasks individually OR your class teacher will show the pictures to your class all at once. It will take about 20 minutes to complete the tasks.

### **What are the benefits of taking part?**

There are no benefits to you if you take part. Information from the research might help us to work better with people with learning disabilities in the future.

### **What if I change my mind about taking part?**



You can change your mind or stop the tasks at any time.

### **What will happen to the answers I give?**



Your answers to the questions will be stored on a computer. This information will be anonymised. This means that it will not have your name on it, so no-one else will know that the answers are yours.

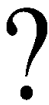


I will write about the study. I will not mention your name or anything else about you or anyone else who takes part in the study.



If you, or your parents have any questions, you can phone me on 0131 537 6349 or email me at [J.Scotland@sms.ed.ac.uk](mailto:J.Scotland@sms.ed.ac.uk).

If you would like to speak to someone who is not part of this study, you can contact Dr Ethel Quayle on 0131 651 3972.



If you would like to make a complaint about the study please contact  
NHS Lothian:  
NHS Lothian Complaints Team  
2<sup>nd</sup> Floor  
Waverley Gate  
2-4 Waterloo Place  
Edinburgh  
EH1 3EG  
0131 465 5708

**Thank you for reading this.**

Appendix 9. Consent form for child control group



**Emotion recognition and people with a learning disability**

**A research study**

**Consent Form – Control Group**

Please read each statement carefully and write your initials in the box if you agree with it.



I have read and understood the information sheet and have had the chance to ask questions.



I understand that I do not have to take part and I can change my mind at any time without giving a reason.



I agree that my data can be used in other research studies that have been ethically approved. This means that people have checked the research is safe.



I understand that responsible people might look at data from the study. I am happy for these people to have access to my data.



I agree to take part in the study.

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of person taking consent

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**South East Scotland Research Ethics Committee 02**

Waverley Gate  
2 - 4 Waterloo Place Edinburgh  
EH1 3EG

13 September 2012

Ms Jennifer Scotland  
Trainee Clinical Psychologist  
NHS Lothian  
Psychology Dept. Mackinnon House  
Royal Edinburgh Hospital  
Edinburgh  
EH10 5HF

Dear Ms Scotland

**Full title of study:**                    **Emotion recognition in people with intellectual disabilities: is there evidence for the emotion specificity hypothesis?**

**REC reference number:**    **12/SS/0128**

Thank you for your email of 13 September. I can confirm the REC has received the documents listed below as evidence of compliance with the approval conditions detailed in our letter dated 14 August 2012. Please note these documents are for information only and have not been reviewed by the committee.

**Documents received**

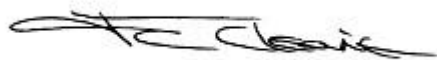
The documents received were as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Protocol	1.3	13 September 2012

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

<b>12/SS/0128</b>	<b>Please quote this number on all correspondence</b>
-------------------	---

Yours sincerely

A handwritten signature in black ink, appearing to read 'Joyce Clearie', written in a cursive style.

**Ms Joyce Clearie Committee Co-ordinator**

E-mail: [joyce.clearie@nhslothian.scot.nhs.uk](mailto:joyce.clearie@nhslothian.scot.nhs.uk)

Copy to: *Ms Marianne Laird,*  
*Ms Karen Maitland, NHS Lothian*

Dr Karen McKenzie  
Senior Lecturer/Chartered Clinical Psychologist  
University of Edinburgh  
School of Health in Social Science  
Teviot Place  
EDINBURGH EH8 9AD

**Date** 11 June 2012  
**Your ref**  
**Our ref** SCS/JAI  
**Direct dial** 0131 469 3162

Dear Dr McKenzie

I am writing in response to your application requesting permission to undertake research in schools in The City of Edinburgh.

Your request has been considered, and I am pleased to inform you that you have been given permission in principle to undertake your research. I must stress that it is the policy of this Authority to leave the final decision about participation in research projects of this kind to Head Teachers and their staff, so that approval in principle does not oblige any particular establishment to take part.

I request that you forward a copy of your completed findings to me when they become available. In this case an electronic summary of your thesis would be preferred. Your work may be of interest to a number of staff in the Children and Families Department.

I would like to thank you for contacting the Children and Families Department about your work, and wish you every success in the completion of your project.

Yours sincerely



JULIE INNES  
Administrative Officer

Mike Rosendale, Head of Schools and Community Services

Appendix 12. Overall scoring sheet for emotion and control tasks.

Identifier.....Date of Birth.....Gender.....

Completed by.....Date of Assessment.....

Child/Child with a learning disability/Adult /Adult with a Learning Disability

School Identifier (if applicable).....

Communication used during interview		
Verbal	Pointing	Looking
Gesture/Sign	Symbols	Other (Please specify)_____

<p><b>Background Information:</b></p>
---------------------------------------

Order of presentation of emotion and control tasks						
Conditions	Control Task			Emotion Task		
	Line drawing	Paired	All presented together	Line drawing	Paired	All presented together
Order						

Score Summary: Control Task				
Condition	Presented Individually	All pictures presented together	Pictures presented in pairs	Score
Line Drawings				
Photos without context				
Photos with context				
<b>Total Score</b>				

<b>Score Summary: Emotion Task</b>				
<b>Condition</b>	<b>Presented Individually</b>	<b>All pictures presented together</b>	<b>Pictures presented in pairs</b>	<b>Score</b>
<b>Line Drawings</b>				
<b>Photos without context</b>				
<b>Photos with context</b>				
<b>Total Score</b>				

<b>Score Summary: Global-Local Task</b>			
	<b>Global</b>	<b>Local</b>	<b>Unrelated</b>
<b>Total Score</b>			

Appendix 13. Table showing means, standard deviations and range for the scores on the emotion and control tasks for each of the three participant groups.

			Emotion Tasks		Control Tasks	
			Mean (SD)	Range	Mean (SD)	Range
<b>Adults with ID</b>	Task	Naming	11.9 (3.5)	5 – 17	23.6 (3.1)	17 – 27
		Recognition from a choice of 9 pictures	14.1 (5.5)	3 – 25	22.7 (4.5)	12 – 27
		Recognition from a choice of 2 pictures	23.8 (3.5)	15 – 27	25.4 (2.1)	20 – 27
	Type of stimuli	Line Drawings	15.5 (3.6)	7 – 21	25.0 (2.5)	16 – 27
		Picture with ‘no context’	17.0 (4.4)	8 – 25	23.1 (4.0)	13 – 27
		Picture ‘with context’	17.4 (4.6)	6 – 24	23.7 (3.5)	15 – 27
		<b>Overall Score</b>	<b>49.8 (11.5)</b>	<b>23 – 69</b>	<b>71.7 (9.3)</b>	<b>51 – 81</b>
<b>Child Control Group</b>	Task	Naming	18.8 (1.8)	16 – 22	26.8 (0.5)	25 – 27
		Recognition from a choice of 9 pictures	21.4 (2.4)	17 – 25	26.9 (0.5)	25 – 27
		Recognition from a choice of 2 pictures	26.4 (0.7)	25 – 27	27.0 (0.0)	27 – 27
	Type of stimuli	Line Drawings	20.8 (1.9)	16 – 24	27.0 (0.2)	26 – 27
		Picture with ‘no context’	22.7 (2.1)	17 – 25	26.8 (0.5)	25 – 27
		Picture ‘with context’	23.2 (1.7)	20 – 26	26.9 (0.3)	26 – 27
		<b>Overall Score</b>	<b>66.7 (3.9)</b>	<b>58 – 73</b>	<b>80.7 (0.8)</b>	<b>78 – 81</b>
<b>Adult Control Group</b>	Task	Naming	19.7 (2.9)	14 – 25	26.3 (1.0)	24 – 27
		Recognition from a choice of 9 pictures	25.5 (2.1)	21 – 27	26.8 (0.6)	25 – 27
		Recognition from a choice of 2 pictures	26.9 (0.3)	26 – 27	27.0 (0.2)	26 – 27
	Type of stimuli	Line Drawings	23.9 (1.4)	21 – 26	27.0 (0.2)	26 – 27
		Picture with ‘no context’	24.4 (2.1)	19 – 27	26.6 (0.7)	25 – 27
		Picture ‘with context’	23.8 (3.0)	18 – 27	26.5 (0.8)	24 – 27
		<b>Overall Score</b>	<b>72.1 (4.4)</b>	<b>62 – 79</b>	<b>80.0 (1.4)</b>	<b>76 – 81</b>

## **LEARNING DISABILITY PRACTICE**

### **Author Guidelines**

#### **Contributing to the journal**

Writing for publication is not as difficult as it may seem as long as contributors follow some simple ground rules.

#### **Introduction**

Learning Disability Practice aims to inform and to encourage critical reflection among nurses and other professionals by publishing articles with clear implications for practice. We welcome contributions to all sections of the journal, including opinion, resources, features, continuing professional development and careers. Articles should be informative, have something new to say, offer a fresh approach to an old subject, challenge current thought or practice or predict future trends. We also welcome letters to the editor. One of the best ways to understand how to write articles is to read a selection of those already published in the journal. They can be literature reviews, original research, descriptions of practice or case studies. Learning Disability Practice also seeks to encourage new authors – do not think writing for publication is too difficult or that no one will want to read what you have to say. You may have several reasons for wanting to publish. You may want to share knowledge and advance your field of practice, to disseminate important findings or opinions, or even to contribute to topical policy debates. In all cases, it is advisable to contact the editor to discuss your ideas. For more advice, email the editor, Colin Parish, at [colin.parish@rcnpublishing.co.uk](mailto:colin.parish@rcnpublishing.co.uk) or telephone +44 (0)20 8872 3153.

#### **Submitting your work**

Material for publication should be submitted exclusively to Learning Disability Practice, which holds the copyright to articles published. Opinion articles of up to 700 words are sought; features should be between 2,000 and 3,500 words long, including the references. A summary or abstract of 75-150 words should be supplied with features and continuing professional development articles. Please ensure that any illustrative material is carefully numbered or labelled and captioned. Photographs will be returned on request. It is the author's responsibility to obtain permission for the use of any illustrative material or photographs submitted. Manuscripts should be formatted in Microsoft Word or as a text file. Articles should be double-spaced and formatting kept to a minimum. Authors should include their full names, qualifications, job titles, contact telephone numbers, fax number, email address and postal address.

Contributions should be submitted via the online submission system at [www.edmgr.com/rcnp-ldp](http://www.edmgr.com/rcnp-ldp), a tutorial for which is available through its 'Instructions for authors' link. An email confirming submission should be sent to [helen.hyland@rcnpublishing.co.uk](mailto:helen.hyland@rcnpublishing.co.uk) at the same time. During the registration and submission process, authors will be asked for contact details and the following information on all of the article's other authors: full name, job title, institution, email address and

country. Each author will receive an email acknowledging receipt of submission and will thereafter be able to track its progress online.

### **Writing style**

Readers of Learning Disability Practice work in all settings and are at different stages of their career. To make article interesting and readable, authors should avoid the use of jargon and abbreviations. Abbreviations should be written in full the first time they are used and in parentheses thereafter. It helps to get someone else to read a draft, to point out anything that is not clearly expressed.

### **Referencing**

It is important that all articles include references where appropriate. Correct referencing is the responsibility of the author. We use the Harvard referencing system; authors should contact the editor for further information.

### **Diversity and preferred terms**

As readers live and work across the UK (and overseas) be explicit about whether you are referring to, for example, policy or legislation, in one country. Where relevant, authors should try to cover material from all four UK countries. The same applies to settings: if authors are writing from an acute perspective, they should consider whether the topic can be generalised.

### **What happens next?**

Most are subject to review by subject experts, and reviewer comments are usually summarised and sent to the lead author. Reviewers often recommend acceptance subject to amendments. As part of the submission process, all authors will be asked to validate their involvement and acceptance of the publisher's agreement. Articles are checked using antiplagiarism software and those containing substantial passages of text similar to previously published work are rejected. Once accepted, articles are edited and prepared for publication. Lead authors of peer reviewed, clinical articles receive proofs shortly before publication. Only minor changes are accepted at this stage.

### **Complaints**

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