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

Authors

Jennifer L. Scotland[1], Karen McKenzie[2,*] Jill Cossar[3], Aja Murray[4,] & Amanda Michie[5]

Affiliations

[1] Dept. of Neuropsychology, NHS Lothian, UK

[2] Dept. of Clinical Psychology, Northumbria University, UK

[3] Dept. of Clinical Psychology, The University of Edinburgh, UK

[4] Dept. of Psychology, The University of Edinburgh, UK

[5]Dept. of Clinical Psychology, NHS Lothian, UK

*Corresponding author
Dept. of Clinical Psychology, Northumbria University, Dept. of Psychology, City Campus, Northumberland Building, Newcastle Upon Tyne, England, NE1 8ST

Email: k.mckenzie@northumbria.ac.uk

Abstract

This study aimed to evaluate the emotion recognition abilities of adults (n = 23) with an intellectual disability (ID) compared with a control group of children (n = 23) without ID matched for estimated cognitive ability. The study examined the impact of: task paradigm, stimulus type and preferred processing style (global/local) on accuracy. We found that, after controlling for estimated cognitive ability, the control group performed significantly better than the individuals with ID. This provides some support for the emotion specificity hypothesis. Having a more local processing style did not significantly mediate the relation between having ID and emotion recognition, but did significantly predict emotion recognition ability after controlling for group. This suggests that processing style is related to emotion recognition independently of having ID. The availability of contextual information improved emotion recognition for people with ID when compared with line drawing stimuli, and identifying a target emotion from a choice of two was relatively easier for individuals with ID, compared with the other task paradigms. The results of the study are considered in the context of current theories of emotion recognition deficits in individuals with ID.

Keywords: Emotion recognition; Intellectual disability; Emotion specificity hypothesis; Facial recognition; Global-local processing

1. 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 & Lunsky, 1997). There is a body of research that indicates that both adults and children with an intellectual disability (ID) have difficulties in recognising and identifying facial expressions of emotions, compared with their counterparts without ID (e.g. McAlpine, Kendall, & Singh, 1991, Owen, Browning, & Jones 2001; Rojahn, Kroeger, & McElwain 1995; Weisman & Brosgole, 1994). A recent review of studies examining the facial emotion recognition abilities of adults with ID, without a specific syndrome, as compared with child or adult control groups without ID, found that all of the studies reported that the participants with ID had an impairment on at least some of the tasks compared to the control group (Scotland, Cossar & McKenzie, 2015).

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). Deficits in this area may, in turn, impact on the ability of people with ID to maintain employment and community placements (e.g. Best-Sigford, Bruininks, Lakin, Hill, & Heal, 1982; Martin, Rusch, Lagomarcino, & Chadsey-Rusch, 1986); may be linked to aggressive behaviour (Matheson & Jahoda, 2005) and, in turn, poorer psychological wellbeing (Rojahn, & Warren, 1997). For example, in respect of employment, a number of studies in this area have indicated that both productivity and social factors, such as social competence were common reasons for job loss, with an associated negative

impact on psychological well-being, self-esteem and social networks (see Banks, Jahoda, Dagnan, Kemp & Williams, 2010 for an overview).

In respect of community placements, early research suggested that limitations in social competence, as well as in cognitive abilities appeared to impact on problems with community placements (see Rojahn, Lederer, & Tassé, 1995). More recent research indicates a more complex interaction between actual and perceived social competence. For example, Phillips and Rose (2010) compared two groups of individuals, while controlling for challenging behaviour, and found that those who had experienced placement breakdown were perceived as being more socially aware by staff. As a result, their challenging behaviour was perceived as being more intentional, resulting in lower levels of staff interaction and support and increased likelihood of placement breakdown.

Given the potential detrimental impact of emotion recognition difficulties for people with ID, research into the possible causes of this impairment is important in order to allow for effective, targeted interventions.

1.1 Theories of emotion recognition deficits in individuals with ID

The recent review by Scotland et al. (2015) noted that methodological differences between the studies precluded any firm conclusions as to the specific nature and cause of the deficit in facial emotion recognition that people with ID were found to have relative to those without ID. There are two main proposals that attempt to explain why people with ID are impaired in recognising facial expressions of emotion. The first, the 'emotion specificity hypothesis,' argues that impaired performance on emotion recognition tasks is a reflection of a *specific* impairment in emotion-perception

competence i.e. that cannot be fully explained by cognitive-intellectual deficits alone (Rojahn, Rabold, & Schneider 1995). The second proposal is that basic emotion perception is intact in people with ID and, instead, that poor performance on emotion recognition tasks is a consequence of poor IQ-related information processing abilities (Moore, 2001).

Evidence for the emotion specificity hypothesis comes primarily from a study by Rojahn et al. (1995). These authors compared the performance of a group of adults with ID with that of a group of 'mental age matched' (i.e. matched on a measure of cognitive ability) children and a group of adults without ID on an emotion recognition task and a control task (estimating the age of individuals from pictures). The authors noted that the two tasks had equivalent task demands and only differed in terms of the cues used to discriminate either emotion or age. They found that the group of adults with ID 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 the control task i.e. recognising if a picture depicted a person who was young or old.

There are a number of methodological strengths of this study, most notably that the authors recruited a matched child control group, 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 ID 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).

Zaja and Rojahn (2008) outlined the methodological considerations pertinent to any 'credible' emotion specificity hypothesis study: at least two groups of participants (individuals with ID 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). One difficulty that is common to many studies of emotion recognition abilities is that the relative complexity and task demands of the emotion and control tasks have not explicitly been measured and compared. As such it is unknown to what extent the results of a given study relate to differences or similarities in task demands. An alternative methodology is, therefore, to examine whether differences in emotion recognition remains between individuals with ID and ability-matched controls. If the former have poorer performance, then the level of emotion recognition ability would not be attributable to cognitive ability alone. This approach is used in the current study.

In contrast to the emotion-specificity hypothesis, Moore (2001) proposed that emotion-perception capacities in people with ID 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 ID and mental-age matched children were found (e.g. Adams & Markham, 1991; Moore, Hobson, & Lee, 1997). These results tended to be found when emotion-perception tasks that made fewer demands on information-

processing capabilities were used. According to Moore (2001) these findings suggested that emotion-recognition capacities may therefore be intact in people with ID and that impaired performance on emotion recognition tasks is instead a reflection of the cognitive-intellectual impairment associated with ID. 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.

Research with individuals with autism spectrum disorder (ASD) suggests a potential explanatory factor. A number of comparative studies have found that some people with ASD demonstrate significant impairment in facial emotion recognition, when compared with typically developing individuals and with other clinical groups (see Harms, Martin, & Wallace, 2010 for an overview) and that the information processing style of the individual may play a role (e.g. Fallshore & Bartholow, 2003). People with ASD are thought to be more likely to employ a processing approach that focuses on the details, or 'local' features of visual information, rather than the 'gist' or 'global' features. This phenomenon is referred to as 'weak central coherence' (e.g. Frith & Happé, 1994; Happé & Frith, 2006).

Successful processing and interpretation 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 (Behrmann, Thomas, & Humphreys 2006). However, limited research has explored processing style and its relationship to emotion recognition capabilities in people with ID without ASD. This is, therefore, an aim of the present study.

1.2 The impact of task demand and context on emotion recognition

Studies examining emotion recognition skills 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 produced their own images (e.g. Maurer & Newbrough, 1987) or used cartoon stimuli (e.g. Brosgole, Gioia, & Zingmond, 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 (Rojahn, Lederer & Tassé, 1995). Additionally, McKenzie, Matheson, McKaskie, Hamilton, and Murray (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 ID 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 (see Scotland et al., 2015 for an overview). These tasks differ 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 versus the impact of IQ-related factors in

people with ID. Moreover, studies have also differed in terms of the range of emotions evaluated, with some including only two basic emotions (happiness and sadness, e.g. Rojahn, Kroeger & McElwain., 1995; Rojahn et al., 1995) and others including eight (Sogon & Izard, 1985). In order to test Moore's (2001) proposal that poor performance on emotion recognition tasks is a consequence of poor IQ related abilities, the present study will examine the relative performance of adults with ID and a child control group on a range of emotions that differ in terms of amount of contextual information and task demands.

1.3 Aims of present study

The present study aims to draw together the different strands of research outlined above which have highlighted a number of factors which potentially influence emotion recognition in individuals with ID. Specifically, the aims are to evaluate the following in relation to the relative emotion recognition deficit found in people with ID (see Scotland et al., 2015):

- the two explanatory models proposed by Moore (2001) and Rojahn et al. (1995) by a. controlling for estimated IQ and b. examining the impact of varying task demand and contextual information
- the impact of processing style (global versus local)

To the authors' knowledge this is the first study to evaluate all of these factors.

Method

2.1 Participants

The study included 23 adults with ID (male = 18, female = 5), with a mean age of 45.7 years (SD = 11.3, range = 25-61 years), and 23 children without ID (male = 11, female

= 12) with a mean age of 10.4 years (SD = 1.7, range = 7-13 years) who were recruited as a control group matched on estimated cognitive ability. Participants with ID were recruited via clinicians working within community and forensic ID services in the local area. Informed consent was obtained from all participants, in the presence of a witness. Child participants were recruited from After School Clubs in the local area. Consent was obtained from parents and assent from the children prior to participation in the study.

Adults with ID were included if they had a diagnosed ID (based on the Diagnostic and Statistical Manual of Mental Disorders [American Psychiatric Association, 2000]), were able to give informed consent and had adequate verbal communication to undertake the tasks. Individuals with a comorbid diagnosis e.g. ASD or specific syndrome e.g. Down syndrome, with a significant visual impairment or known major psychiatric disorder, such as schizophrenia or clinical depression, or current prescribed psychotropic medication were excluded. Children were included if they had adequate verbal communication to perform the task and if they and their parents consented to participation. Children were excluded if they had ID or other developmental disorder, a major psychiatric disorder or a significant visual impairment.

2.2 Materials

2.2.1Estimating cognitive ability

The Learning Disability Screening Questionnaire (LDSQ: McKenzie & Paxton, 2006; Paxton, McKenzie & Murray, 2008) and Child and Adolescent Intellectual Disability Screening Questionnaire (CAIDS-Q: McKenzie, Paxton,

Murray, Milanesi, & Murray, 2012) were completed for participants in the ID and child groups, respectively, using information from a person 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 given a score of 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 and to have good specificity and sensitivity (McKenzie & Paxton, 2006; McKenzie et al., 2012). The available data on the correlation of the LDSQ and CAIDS-Q (McKenzie & Murray, 2015) with Full-Scale IQ scores 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 ID and child control groups. Based on this conversion, the participants with ID had a mean estimated IQ of 68.3 (SD = 7.69) and the child control group had a mean adult equivalent estimated IQ of 74.24 (SD = 9.43).

2.2.2 Emotion recognition measures:

An updated version (revised to include expressions of disgust, surprise and neutrality) of the 'Feelings and Emotions' assessment (McKenzie et al., 2001) was administered to all participants. The pictures in the revised version were initially piloted with a group of people who worked in the area of child development and/or ID 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 $\alpha = .940$.

The measure comprises three sets of materials (Line drawings, Photographs of the face only ['no context'], and Photographs of people displaying the emotion in context, e.g. someone looking scared holding a snake ['with context']. The materials are all in colour and depict nine emotions: happy, sad, afraid, angry, bored, worried, surprised, disgust and a neutral expression. 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. Copies of the materials can be obtained from the second author.

Each of the three sets of pictures comprised three separate tasks: emotion naming/labelling; emotion recognition of target emotion from a choice of nine; emotion recognition of target emotion from a choice of two. The emotion labelling task involved asking participants to name the emotion depicted in individual pictures. The first emotion recognition task involved presenting all nine emotion pictures simultaneously and asking the participant to choose the picture that matched the target emotion, e.g. 'Which picture shows a person who is scared?' The second emotion recognition task, required the participant to identify the target emotion from a choice of two.

As the ethnic origin of the participants were white, British, all but two of the emotion pictures depicted white individuals, with one picture from each of the 'no context' and 'with context' materials depicting an individual from a minority ethnic background.

Overall both the emotion and control tasks comprised of three sections, each with 27 trials, with the amount of contextual information being varied within each section: naming, recognition 1 (choosing the correct emotion from a choice of nine pictures) and recognition 2 (choosing the correct emotion from a choice of two pictures). No prompts were provided during the naming trials and there was no time limit imposed for responding. All correct responses were given a score of one and were scored according to pre-defined scoring criteria. These were based on commonly accepted synonyms for the target emotion or colour. For example a response of 'unhappy' 'miserable' or 'sad' would receive a score of one point if the picture depicted a sad person. Total scores were calculated to give an overall correct score (possible range 0 – 27), as well as a total correct score for each task paradigm (naming, choice of nine and choice of two, each with a possible range of 0 - 9) and for each stimulus type (line drawings, photographs without context and photographs with context, again each with a possible range of 0 - 9).

2.2.3 *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. 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 nine and a choice of two). These tasks were administered in order to control for the cognitive demands of the tasks. 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 $\alpha = .936$.

2.2.4 Global-local task

Based on the methodology outlined by Gross (2005), 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 target images were presented in total and participants were asked to voice their response or to point to their desired response for each item.

2.3 Procedure

Ethical approval for the study was obtained from the first author's educational establishment at the time of the study, from the education department and from the National Health Service research ethics committee.

Participants in both the ID and child control groups completed the tasks on a one-to-one basis with the first author. Participants were able to have someone they knew present during testing, although this person did not participate in the assessment process in any way and sat out of view during the assessment itself. Images were presented on a laptop, in the form of a PowerPoint presentation and participant responses were recorded on a response sheet.

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

2.4 Analyses

Data were firstly checked for normality and outliers. Subsequently, a multiple regression model was used to assess the emotion specificity hypothesis. The outcome variable was emotion recognition ability and the predictors were cognitive ability and group (ID versus control). Although the groups were already matched for cognitive ability, we included cognitive ability as a covariate with the goal of accounting for any remaining differences between groups after matching. We also controlled for residual sex differences in this way i.e. including sex as a covariate in the model, based on the evidence that suggests that males and females may differ on tasks that involve making perceptual judgements (Kramer, Ellenberg, Leonard, & Share, 1996; Roalf, Lowery, & Turetsky 2006). Doing this provides an estimate of the group difference in emotion recognition 'as if' they did not differ on cognitive ability or sex. This allowed us to test the emotion specificity hypothesis because any differences observed in emotion recognition ability could – assuming that cognitive ability were successfully eliminated - be considered differences over and above any differences due to cognitive ability.

Following this, to examine Moore's assertion that any differences in emotion recognition ability may be due to IQ related difficulties on the part of people with ID, such as processing ability, an independent samples *t* test was used to compare the performance of the two groups on the task with the fewest cognitive demands. This

task was chosen based on the performance of the groups on particular tasks, according to task demand and amount of contextual information available.

Finally, we assessed whether any specific deficits in emotion recognition in individuals with ID could be explained by a local (versus global) style of processing. We did so by first residualizing both emotion recognition scores and global-local processing style on sex and IQ. We then used these adjusted score in a simple mediation model with X = group (ID versus control), M = IQ- and sex- adjusted global-local processing style and Y= IQ- and sex- adjusted emotion recognition scores. Using these variables we estimated three regression equations:

$$Y_i = b_0 + b_1 X + \varepsilon_i, \tag{1}$$

$$M_i = b_0 + b_2 X_i + \varepsilon_i, \tag{2}$$

$$Y_i = b_0 + b'_1 X_i + b'_2 \; _i + \varepsilon_i, \tag{3}$$

We then computed the product $b_1 \times b_2$ as an estimate of the mediated effect of group on emotion recognition ability. We tested its statistical significance using bootstrapped standard errors, with 1000 bootstrap samples. In addition, b'_1 provided an estimate of the direct effect of group on emotion recognition ability.

4.**Results**

4.1Demographic information

There were significantly more females in the child control group (X^2 = 4.572, df = 1, p =.032) and they also had a significantly higher mean estimated IQ equivalent score (t(44) = -2.325, p = 0.025).

4.2 Emotion and control tasks

The means, standard deviations and ranges for the scores on the emotion and control tasks, stratified by task paradigm and stimulus type for each of the participants groups are presented in Table 1. As the child control group performed almost universally at ceiling level on the control task, these results could not be used in subsequent analyses. This is because valid inferences about group by task interactions cannot be made when one group is performing at ceiling (or floor) on one of the tasks (Facon, Magis & Belmont, 2011)

Insert Table 1 about here

4.3 Analyses relevant to the emotion specificity hypothesis

The control group performed better and showed less variability in task performance, based on emotion recognition scores, than the individuals with ID.

Results of the multiple regressions are provided in Table 2. These show that after controlling for ability, the control group performed significantly better than the individuals with ID on emotion recognition. This provides some support for the emotion specificity hypothesis.

Insert Table 2 about here

4.4. Impact of stimulus type

A within-subjects ANOVA found a significant main effect of stimulus type on response accuracy on the emotion recognition tasks for individuals with ID [$F(2,42) = 4.708$, $p = 0.014$]. Pairwise comparisons illustrated significantly better performance on the tasks that included contextual information, only when compared with tasks that used line drawings ($p = 0.034$, $d = 0.46$).

A significant main effect of stimulus 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 worse on the tasks that involved line drawings, when compared with images both without context ($p = 0.01$, $d = -0.95$) and with context ($p < 0.001$, $d = -1.33$).

4.5 Impact of Task Paradigm

A within-subjects ANOVA illustrated a significant main effect of task type for individuals with ID [$F(2,42) = 175.075$, $p < 0.001$]. Post-hoc comparisons indicated that performance was significantly better when the task was to identify the target emotion from a choice of two pictures compared with both naming the emotion ($p < 0.001$, $d = 3.4$) and when asked to identify the target from a choice of nine pictures ($p < 0.001$, $d = 2.10$). Performance was also significantly more accurate when the task was to identify the target from a choice of nine pictures compared with naming the emotion in the picture ($p = 0.025$, $d = 0.48$).

A significant main effect of task type was also found for the child control group [$F(2,44) = 153.496$, $P < 0.001$]. Post-hoc analyses indicated that participants performed better when asked to identify the target emotion from a choice of two images, compared with when asked to name the emotion ($p < 0.001$, $d = 5.57$) and when asked to identify the target emotion from a choice of nine ($p < 0.001$, $d = 2.83$).

Based on the results of the previous analyses, an independent *t* test was used to compare the two groups on the task that was indicated as having the lowest cognitive demand; identifying a target emotion from a choice of two pictures which had relevant contextual information. A significant difference between the two groups was found [$t(43) = -2.4$, $p = .021$] with the child group scoring better ($M = 8.7$, $SD = .47$) than the participants with ID ($M = 8$, $SD = 1.3$).

4.6. *Global-Local task responses*

The mean frequencies with which participants in each group selected global items, local items and unrelated items in the response sets are shown in Table 3. This shows that the participants with ID had a higher mean 'local' score than 'global' score, indicating a more detail focused processing style, while the opposite was true for the child control group.

Insert Table 3 about here.

The results of the mediation test are provided in Table 4. Models 1, 2 and 3 refer to equations 1, 2 and 3 respectively.

The 'Group' effect in model 1 (b_1 in equation1) shows that that having ID was significantly negatively associated with emotion recognition performance. However, having an intellectual disability did not significantly predict a more local processing style in model 2 (b_2 in equation 2). Local processing style did not significantly mediate the relation between having ID and emotion recognition (95% CI for the indirect effect was -5.28 to 0.05). Local processing style did, however, significantly predict emotion recognition ability after controlling for group (b_3 in equation 3). Here, controlling for ID, having a more local processing style predicted poorer emotion recognition performance. This suggests that processing style is related to emotion recognition independent of ID.

Insert Table 4 about here.

5.**Discussion**

This study aimed to evaluate the ability of adults with ID to name and recognise facial expressions of emotion. Of particular interest was whether further evidence to support any of the explanatory models for the deficit in emotion recognition 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 ID to recognise facial emotional expressions.

5.1Emotion Specificity Hypothesis

The group of participants with ID demonstrated overall impairment in facial emotion recognition when compared with a child control group. After controlling for residual differences in estimated cognitive ability and sex between the two groups,

individuals with ID were found to be performing significantly worse than the control group. This confirms previous, early findings in this area (Moore, 2001; Zaja & Rojahn, 2008) and provides some support for the emotion specificity hypothesis.

This consistency across studies was found despite some methodological differences, including the ways in which the children were matched on ability with adults with ID. The present study also included nine different expressions of emotion which varied in the amount of contextual information available and by task demand. By contrast, Rojahn et al. (1995) only measured performance in relation to happiness, sadness and a neutral expression.

Unfortunately it was not possible to conduct a valid comparison between the two groups on the control tasks in the present study because the child group performed almost universally at ceiling level on these tasks. Moore (2001) highlights the importance of employing control tasks that are of equal complexity to the index (emotion recognition) tasks. While the control tasks used in the present study met the criteria proposed by Moore (2001) in terms of requiring the same response demands as the index task and using equivalent stimuli, the pattern of responses clearly suggested that the control tasks were too easy for the child group. Future research is needed to explore the relative difficulty of emotion and control tasks used in comparative research.

The present study found mixed results for the response accuracy of the participant groups in terms of the impact of the stimuli used. Participants with ID 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. Both of these

findings are consistent with previous results found by McKenzie et al. (2001) and support the recommendation that communication programmes for people with ID should perhaps make use of photographs that have meaning to the individual, rather than symbols or line drawings.

This has implications in terms of the interpretation of findings from previous studies that use cartoon or schematic based representations of emotions, which may have over-estimated the extent of any emotion recognition impairment observed in people with ID (e.g. Weisman & Brosgole, 1994).

In terms of task demand, the present study found that both 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 ID.

The results of these analyses were also used to explore Moore's proposal that any deficits in emotion recognition ability shown by people with ID may be due to IQ related difficulties, rather than being a specific emotion deficit. The task with the fewest cognitive demands, based on performance, was identifying a target emotion from a choice of two pictures which had relevant emotional context. The participants with ID scored significantly lower than the child control group on this task, suggesting that an emotion recognition deficit remains, even when cognitive demands of the task are low.

5.2 Cognitive processing style

The present study also explored whether cognitive processing style in people with ID may play a role in the observed deficit in emotion recognition. It was found that while those with ID had a significantly poorer performance, this was not significantly related to having a more local processing style and that local processing style did not significantly mediate the relation between having ID and emotion recognition. Local processing style does, however, seem to play a role in emotion recognition. When group (individuals with ID and child controls) was controlled for, having a more local processing style predicted poorer emotion recognition performance. This indicates that processing style is related to emotion recognition independently of whether the individual has ID or not.

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).

Previous studies in this area have tended to focus on examining the perceptual abilities of people with ASD, in particular with regard to facial perception. Such studies have generally reported that people with ASD are less inclined to regard faces as organised wholes when identifying emotional expression (e.g. Gross, 2005; Klin et al., 2002). As participants with a more local processing style were found to be poorer at emotion recognition, irrespective of group, and none of the participants had a diagnosis of ASD, the results suggest that relationship between a more local processing style and impaired facial perception that has been found to be present in people with ASD may also be evident in people without ASD.

The present study provides some evidence for the *specificity* of emotion recognition impairments in people with ID, but also suggests that differences in cognitive processing style more generally could account for poorer performance in emotion recognition. This is important to consider in the design of appropriate control tasks in future studies, to ensure that the control task does not favour a more local processing style while the emotion task requires a more global processing style.

5.3 Limitations

The study had a number of limitations, some of which have been discussed, including difficulties associated with selecting a control task with equivalent task demands to the emotion recognition tasks. In addition, the analyses were based on relatively small sample sizes, with fewer females than males participating. While the study controlled for sex, future research with larger numbers of participants overall and a better balance of the sexes would be helpful. In addition, while the age range of participants with ID in the current study was broadly similar to that of other studies in this area, the mean age was somewhat higher (see Scotland et al., 2015). Age may potentially impact negatively on emotion recognition ability in people with ID (McKenzie et al., 2001), although the only other study examining this, found no relationship between age and emotion recognition ability (Leung & Singh, 1998).

A further limitation relates to the method that was used to match the two groups on estimated cognitive ability. This was done using two short screening questionnaires, the LDSQ and CAIDS-Q, rather than an intellectual assessment. While previous research has found both the LDSQ (Paxton et al., 2008) and CAIDS-Q (McKenzie, Murray, Murray, & Murray, 2014) to be comparable with short forms of the Wechsler

intelligence scales in terms of classification accuracy and to have advantages in terms of speed and ease of administration, matching the groups, based on the results of a standardised intellectual assessment would have been more robust.

The mean estimated IQ of the participants with ID, indicated that they were likely to fall within the 'mild' range. This is likely to be a result of the inclusion criteria of the study being that the individuals were able to give informed consent to participate and that they had the ability to understand and complete the tasks. The extent to which the results can be generalised to individuals with more severe levels of cognitive impairment, is, therefore unknown.

Future research which evaluates the relative task complexity of emotion recognition and control tasks based on a larger sample size will allow further robust evaluation of the emotion specificity hypothesis to take place.

5.4Conclusions and future research

The results of this study have implications in terms of informing the methodology of future interventions designed to improve the emotion recognition skills of people with ID. For example, our work suggests that if images are being used, including more emotionally relevant context may be helpful e.g. people looking happy at a wedding. Likewise, initially reducing the tasks demands, such as asking individuals to pick a target emotion from a choice of two, may lead to more early success and sustain interest and motivation. It is also 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, Weston, Dennis, & Snell, 2008). Thus an intervention that primed individuals with ID to focus on more global features of facial emotion, may result in more accurate emotion recognition. The extent to which any improvements would generalise to the more ecologically valid task of recognising emotions from all available cues, including movement and context, is, however, unknown.

In conclusion, adults with ID demonstrated relative impairment on tasks of facial emotion recognition when compared with a child control group, after controlling for residual differences in age and gender. This finding provides some support for the emotion specificity hypothesis (Rojahn et al., 1995). The study also found that having a more local processing style predicted poorer performance at emotion recognition, irrespective of group.

What this paper adds

To the authors' knowledge this is the first paper to evaluate the impact of a number of key factors which potentially influence emotion recognition in people with ID, including task demand, stimulus type and processing style. In this context the paper was also able to examine the two explanatory models proposed by Moore (2001) and Rojahn et al. (1995) by a. controlling for estimated IQ and b. examining the impact of varying task demand and contextual information.

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.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders (Text revision.)*. Washington DC: APA.

Banks, P., Jahoda, A., Dagnan, D., Kemp, J., & Williams, V. (2010). Supported employment for people with intellectual disability: The effects of job breakdown on psychological well-being. *Journal of Applied Research in Intellectual Disabilities, 23* (4), 344–354.

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

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

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

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

Facon, B., Magis, D., & Belmont, J. M. (2011). Beyond matching on the mean in developmental disabilities research. *Research in developmental disabilities, 32,* 2134-2147.

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

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

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. & 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., & Wallace, G.L. (2010). Facial emotion recognition in autism spectrum disorders: a review of behavioral and neuroimaging studies. *Neuropsychology Review, 20,* 290-322.

Hext, L.J. & Lunsky, Y. (1997). Relationships etc. – a social skills programme. *Habilitative Mental Healthcare Newsletter, 16*, 7-10.

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

Klin, A., Jones, W., Schultz, R., Volkmar, F., & 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., & Share, L. (1996). Developmental sex differences in global-local perceptual bias. *Neuropsychology, 20*(3), 402-407.

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

Leung, J. P. & Singh, N. N. (1998). Recognition of facial expressions of emotion by Chinese adults with mental retardation. *Behavior Modification*, 22(2), 205-216.

Martin, J.E., Rusch, F.R., Lagomarcino, T., & 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. & 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. & 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., & 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. & Murray, G.C. (2001). A picture of happiness. *Learning Disability Practice, 4*(1), 26-29.

McKenzie, K. & Murray, A.L. (2015). Evaluating the use of the Child and Adolescent Intellectual Disability Screening Questionnaire (CAIDS-Q) to estimate IQ in children with low intellectual ability. *Research in Developmental Disabilities, 37*, 31-36.

McKenzie, K., Murray, A.L., Murray, K.R., & Murray, G.C. (2014). Assessing the accuracy of the WISC-IV seven subtest short form and the Child and Adolescent Intellectual Disability Screening Questionnaire in identifying intellectual disability in children. Child Neuropsychology: *A Journal on Normal and Abnormal Development in Childhood and Adolescence, 20*(3), 372-7.

McKenzie, K. & 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., Milanesi, P. & 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., & 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.

Navon, D. (1977). Forest before trees: the precedence of global features in visual perception. *Cognitive Psychology, 9,* 353-383.

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.

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

Perfect, T.J., Weston, N.J., Dennis, I., & 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.

Phillips, N. & Rose, J. (2010). Predicting placement breakdown: Individual and environmental factors associated with the success or failure of community residential placements for adults with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities, 23,* 201–213.

Roalf, D., Lowery, N., & 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., Kroeger, T.L., & 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., & 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 on Mental Retardation, 99*(5), 477-486.

Rojahn, J. & 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.

Scotland, J., Cossar, J., & McKenzie, K. (2015). The ability of adults with an intellectual disability to recognise facial expressions of emotion in comparison with typically developing individuals: a systematic review. *Research in Developmental Disabilities, 41-42*, 22-39, doi:10.1016/j.ridd.2015.05.007

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

Weisman, J. & 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.

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

Table 1

Means, standard deviations and range for the scores on the emotion and control tasks for the two participant groups.

	Emotion Task		**Control Task**		**Emotion Task**		**Control Task**	
	Adults with ID				**Child**			
Task	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Naming	11.9 (3.5)	5 – 17	18.8 (1.8)	16 – 22	23.6 (3.1)	17 – 27	26.8 (0.5)	25 – 27
Recognition from a choice of 9 pictures	14.1 (5.5)	3 – 25	21.4 (2.4)	17 – 25	22.7 (4.5)	12 - 27	26.9 (0.5)	25 – 27
Recognition from a choice of 2 pictures	23.8 (3.5)	15 – 27	26.4 (0.7)	25 – 27	25.4 (2.1)	20 – 27	27.0 (0.0)	27 – 27
Type of Stimuli								
Line Drawings	15.5 (3.6)	7 – 21	20.8 (1.9)	16 – 24	25.0 (2.5)	16 – 27	27.0 (0.2)	26 – 27
Picture with ‘no context’	17.0 (4.4)	8 – 25	22.7 (2.1)	17 – 25	23.1 (4.0)	13 – 27	26.8 (0.5)	25 – 27
Picture ‘with context’	17.4 (4.6)	6 – 24	23.2 (1.7)	20 – 26	23.7 (3.5)	15 – 27	26.9 (0.3)	26 – 27
Overall Score	**49.8 (11.5)**	**23 – 69**	**66.7 (3.9)**	**58 – 73**	**71.7 (9.3)**	**51 – 81**	**80.7 (0.8)**	**78 – 81**

Table 2

Emotion specificity hypothesis multiple regression results

	Regression coefficient	**SE**	***t***	***p***
Intercept	26.2	12.1	2.2	.04
Ability	0.07	0.18	0.36	.72
Sex	-0.04	3.2	-0.01	.99
Group (0=ID, 1=control)	17.9	3.3	5.5	<.001

Table 3

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).

Participant group	**Global-local processing task**		
	Global	**Local**	**Unrelated**
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
Intellectual 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)

Table 4:

Mediation by local processing style multiple regression results

	Regression coefficient	**SE**	***t***	***P***
Model 1, Outcome= Emotion Recognition				
Intercept	-21.07	4.97	-4.23	<.001
Group	14.15	3.16	4.47	<.001
Model 2, Outcome= Local processing style				
Intercept	1.50	0.85	1.77	.08
Group	-1.01	0.54	-1.87	.07
Model 3, Outcome= Emotion recognition				
Intercept	-23.81	4.95	-4.81	<.001
Local processing style	1.83	0.86	2.13	.04
Group	15.99	3.16	5.06	<.001