Northumbria Research Link

The impact of contextual information on the emotion recognition of children with an intellectual disability

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Abstract

Background

Research suggests that having relevant contextual information can help increase the accuracy of emotion recognition in typically developing (TD) individuals and adults with an intellectual disability (ID). The impact of context on the emotion recognition of children with ID is unknown.

Method

Emotion recognition tasks, which varied in terms of contextual information, were completed by 102 children (45 with and 57 without ID).

Results

There was a significant effect of age and group, with older and TD children performing better on average. There were significant group by condition interactions, whereby children with ID were more accurate at identifying emotions depicted by line drawings compared with photos with contextual information that was not directly related to the emotion being depicted. The opposite was found for TD children.

Conclusions

These results have implications for socio-emotional interventions, such as universal school programmes.

Keywords: Emotion recognition, Intellectual disability, context

Introduction

The importance of a range of socio-emotional competencies to the learning, social relationships, and future outcomes of children is increasingly being recognised (Connolly, Miller, Mooney, Sloan, & Hanratty, 2016; Garcı´a-Villamisar, Rojahn, Zaja, & Jodra, 2010; Rojahn & Warren, 1997). One such competence is the ability to recognise and label emotions in the self and others. Emotion recognition skills are thought to contribute to the child developing an understanding of the perspectives of other people and the ability to regulate their own emotions (see Connolly et al., 2016). By contrast, difficulties with emotion recognition can play a role in the social rejection, exclusion, and victimisation of children by their peers, as well as the extent to which they are perceived as being socially capable (Leppanen & Hietanen, 2001; Mostow, Izard, Fine, & Trentacosta, 2002).

The requirement to support the socio-emotional needs of children has been recognised and addressed in many countries, including the United Kingdom (UK), both at policy level (see National Children's Bureau, 2014) and in practice. The latter is commonly implemented through the introduction of universal school-based programmes (see Connolly et al., 2016).

With the integration of children with a range of developmental difficulties into mainstream schooling in the UK, there is a need for such programmes to take account of the difficulties that particular groups of children may have with emotion recognition in order to maximise the effectiveness of interventions.

One such group is children with an intellectual disability (ID). Research suggests that many children with ID have difficulty recognising and labelling facial emotion expressions (e.g. Wishart, Cebula, Willis, & Pitcairn, 2007). Such difficulties are also found in many adults with ID (e.g. Scotland, Cossar, & McKenzie, 2015). As with those who are typically developing (TD), for some people with ID difficulties in recognising and interpreting emotions have been found to be associated with a number of negative outcomes, including poor social skills and, in some cases, the expression of challenging behaviour (Moffatt, Hanley, & Donnellan, 1995).

The nature and extent of the emotion recognition difficulties that people with ID display in comparison to their TD peers is, however, still somewhat unclear. This is for a number of reasons, for instance the inclusion in some studies of participants with diagnoses which have high co-morbidity with ID and are also associated with deficits in emotion recognition,

such as Autism Spectrum Disorder (ASD; e.g. Garcı´a-Villamisar et al., 2010).

There is also considerable variation between studies in terms of the range of emotions being tested, the type of task demand (e.g. naming an emotion from a picture versus choosing a picture that depicts a particular emotion), the age and language ability of the participating children and the ecological validity of the stimulus materials which are used (for an overview, see Evers et al., 2014).

In respect of age and language ability, research suggests that language level has a significant influence on emotional understanding and that both develop with age, with the relationship being found in children as young as three years. There are, however, individual differences in both language ability and emotional understanding within and between age groups, making it difficult to determine a specific age or language ability level that would be required for emotional understanding (Pons, Lawson, Harris, & de Rosnay, 2003).

In respect of the ecological validity of the stimuli, researchers have used stimuli which differ in terms of whether the emotions are depicted by humans or animals, whether they are

static or moving, and the amount of contextual information that is available (for an overview, see Scotland et al., 2015).

Contextual information refers to information about the situation or context in which the emotion is being expressed. This may range from no contextual information, as depicted in a simple line drawing, to rich contextual information, such as in an image of a child looking happy while opening a birthday present. Variations in the emotion stimuli that have been used across studies are likely to have influenced the results, as both the amount and type of contextual information provided have been found to impact on the ability to recognise and label emotions. For example, in a review of research with TD people, Barret, Mesquita, and Gendron (2011) concluded that having contextual information available is likely to help emotion perception. Similar results have been found with adults with ID. McKenzie, Matheson, McKaskie, Hamilton, and Murray (2001) found that adults with ID were significantly more accurate in labelling an emotion when it was depicted in a photograph with contextual information, e.g. people looking sad at a funeral, compared with a line drawing with no context. Similarly, Matheson and Jahoda (2005) found that the accuracy of individuals with ID at identifying emotions increased as the amount of contextual information increased. A more recent study by Scotland, McKenzie, Cossar, Murray, and Michie

(2016) examined the emotion recognition abilities of adults with ID and of TD children matched on estimated cognitive ability. The authors found that having more contextual information was related to significantly better emotion recognition for both groups.

There is, however, very limited research about the symbolic understanding of children with ID of emotion stimuli, such as line drawings and photographs. Research with TD children suggests that very young infants respond to pictures as if they were real objects, with black and white line drawings eliciting less response than photographs (Pierroutsakos & DeLoache, 2003). At 18 months old TD children understand that pictures and words can relate to 'concrete' objects, while children aged 24-36 months understand that pictures are intentionally created symbolic artefacts. Children aged 36-48 months develop an understanding that pictures often have a communication function and serve as symbolic communication systems in a social context (see DeLoache, 2004 for an overview).

There is a lack of similar research about the development of understanding of symbols by children with ID. This is despite the fact that symbols such as line drawings and photographs are commonly used with people with ID as a way of promoting understanding (Chinn & Homeyard, 2017)

Very few studies have examined the impact of contextual information on emotion recognition in children and, to the authors' knowledge, no research has been conducted that explores this with children with ID. As the processing of contextual information is thought to be automatic, occurring at an early age (Barrett et al., 2011), and beneficial to emotion recognition in TD children (Scotland et al., 2016; Theurel et al., 2016), there is a need to explore whether having contextual information available is also of benefit to children with ID. The present study, therefore, aims to explore the role of context in emotion recognition in children with and without ID. It is hypothesised that both groups of children will be more accurate in identifying emotions depicted in stimuli with more contextual information, as compared with line drawings.

Method

Ethical approval

Approval for the study was obtained from the first author's educational establishment and the local education department in respect of the children recruited in Scotland.

Recruitment

Children with ID were recruited from special education and mainstream schools with special educational provision in the

UK. Information sheets and consent forms were circulated via the participating schools to parents. Parents completed and returned the consent form and a short information sheet about their child if they wished their child to participate. As the project took place in an educational setting, there was no access to diagnostic information from the children's medical files. The parents were, therefore, asked to provide information about any diagnosis that the child had. Children without ID were recruited via mainstream schools following the same procedure.

Participants

Forty-five children with ID participated (males = 27, females = 18) with an average age of 12.2 years (SD = 2.9; range = 5-16 years). Three of the children had a specific syndrome (Down Syndrome, Fragile X Syndrome, and Prader-Willi Syndrome). Children with a diagnosis of ASD were excluded from the analyses due to the association between ASD and difficulties with emotion recognition.

Fifty-seven children without ID participated (males = 32, females = 25) with an average age of 9.1 years (SD = 2.0; range = 5-13 years).

Procedure

The children were assessed individually in their school setting. The younger children and those children who were identified by the class teacher as needing some additional support had a familiar teaching assistant present with them during the assessment. The children were asked to complete the following:

Emotion naming. The children were presented with individual pictures depicting nine different emotions – happy, sad, afraid, worried, angry, bored, surprised, disgusted, and neutral – and asked to name the emotion depicted in the picture. The pictures varied in the amount of emotional cues available from line drawings to photographs of people with limited context to photographs with context relevant to the emotion being depicted (e.g. people looking happy at a wedding). All nine emotions were depicted at each level of contextual information, providing a possible maximum score of 9 for each level of context and a possible total maximum score of 27 across the three levels of context. The stimuli are available from the first author and an example is provided in Table 1.

INSERT TABLE 1

This emotion task was based on an updated version of the assessment developed by McKenzie et al. (2001) and used in a number of previous studies (e.g. McKenzie et al., 2018;

Scotland et al., 2016). The updated version included the emotions 'surprise,' 'disgust', and 'neutral'. Line drawings were commissioned from an artist and depicted only a face. The photographs, all of which had a creative commons licence allowing their re-use, were sourced from Flickr (https://www.flickr.com/). The pictures were presented in the same order to all of the children.

The stimuli were first piloted with a small group of advisors who had experience of child development and of working with children with ID, who both completed the task using the stimuli and provided feedback about them in terms of suitability. The pictures that were retained after this initial stage were then piloted with a large adult general population sample in order to examine their relative difficulty and other psychometric properties (Authors names withheld in line with guidance for blind review, submitted). Subsequent research has used the stimuli with adults and children with and without developmental disabilities (McKenzie et al., 2018; Scotland et al., 2016).

The children were also asked to complete a control task that involved them naming the colour of hair or eyes in similar stimuli to help ensure that they understood the nature of the tasks.

Analysis

A multi-level model, in which condition-specific scores were nested within individuals, was used to explore how contextual information impacted on the emotion recognition of children with ID and TD children. We included condition (coded as a categorical variable) as a level-1 predictor and age and group as level-2 predictors. We included random effects for intercept and condition and a cross-level interaction between group and condition. The model was fit using the nlme package (Pinheiro et al., 2016) in R statistical software (R Core Team, 2016). Scripts are available from the first author.

Results

The range, mean, and standard deviations for the scores in each of the emotion conditions and overall are shown in Table 2. This shows that children with ID had lower overall scores on emotion recognition compared with their TD peers. Children with ID, on average, had higher scores on the line drawings i.e. no context, and the lowest scores on the stimuli with contextual information that was relevant to the picture being depicted. The TD children scored better, on average, with pictures with some contextual information and had the lowest scores when naming emotions from line drawings.

INSERT TABLE 2

The impact of context on performance

Figure 1 summarises the patterns of scoring across groups and conditions. The bars indicate the standard errors of the means. It illustrates that while the TD children scored higher across all conditions, the TD children and those with ID showed different patterns of scores across the conditions. Most notably, the TD children performed poorest in the line drawing condition, while the children with ID group performed best in this condition. Multi-level model results are provided in Table 3.

INSERT FIGURE 1 AND TABLE 3

There was a significant effect of age (t = 4.27, p<0.001) and group (t = 7.56, p<0.001), with older and TD children performing better on average. There was no significant effect of the line drawings and highly contextual photographs condition compared with photographs with limited context; however, there were significant group by condition interactions. Here, children with ID benefitted from the line drawing condition relative to the limited context condition, whereas TD children showed the opposite effect (t = -3.55, p<0.001).

Discussion

The study aimed to explore the impact of contextual information on the emotion recognition of children with and without ID. Overall, children with ID were found to be less accurate at emotion recognition. This is consistent with previous research that has indicated that children with ID experience difficulties with emotion recognition compared with their TD peers (Wishart et al., 2007). In addition, overall, older children were more accurate at emotion recognition. Previous research by McKenzie et al. (2001) found a significant, negative correlation between age and emotion recognition for adults with ID, but a positive correlation for TD children on the same tasks. In general, research with TD children indicates an improvement in emotion recognition with age (for an overview, see Rump, Giovannelli, Minshew, & Strauss, 2009) and that contextual information is helpful (e.g. Scotland et al., 2016).

Our hypothesis that the children would be more accurate in identifying emotions depicted by stimuli with more contextual information, as compared with line drawings, was only supported for the TD children. For children with ID, the opposite effect was found in that having *less* contextual information was more helpful in terms of accuracy on the emotion naming tasks. These children were more accurate at naming emotions depicted in line drawings compared with photographs with some contextual information. There was,

however, no significant difference in accuracy between line drawings and photographs rich in context relevant to the emotion.

These results suggest that there may be an optimal level of contextual information that is helpful to emotion recognition and that this may vary according to whether the child has ID or not, irrespective of the age of the child. The potentially different impact of context for individuals with and without ID in relation to emotion recognition may need to be taken into account when interpreting the results from emotion recognition studies, as well as when considering supporting emotion recognition in practice.

For example, our results suggest that, for children with ID, it may be better to use learning materials that are either very rich in cues about the emotion being depicted or that focus on the key facial emotion cues (such as line drawings), cutting out extraneous information that may be distracting and does not help the child interpret the emotion. Indeed, Moore (2001) has suggested that people with ID may perform worse on emotion recognition where the task makes greater demands on memory and attention, imagination, or requires the processing of ambiguous stimuli.

Rojahn, Rabold, and Schneider, (1995), however, propose that difficulties with emotion recognition result from a specific deficit in emotion perception that is not fully explained by the cognitive difficulties of the person with ID (the emotion specificity hypothesis -ESH). The researchers conducted a comparative study of the facial emotion recognition abilities of three groups: adults with and without ID and children who were matched on a measure of intellectual ability with the participants with ID. All participants completed an emotion recognition task (recognising neutral, happy and sad facial expressions) and a control task (indicating whether the person was young or old). The participants with ID were found to perform significantly worse on the emotion task as compared to the child control group, but no significant differences were found on the control task, leading the authors to conclude that the participants with ID had a specific difficulty with facial emotion recognition.

There were, however, some limitations of this study: only three emotional expressions were used and the stimuli, black and white photographs of faces, provided limited contextual information which may have disadvantaged the participants with ID. Moore (2001) also noted that the group difference between participants with ID and the child control group resulted from the differences in rating the neutral expression -

no differences were found in respect of the happy and sad expressions.

In contrast to the ESH, Moore (2001) suggests that, rather than resulting from a *specific* deficit in emotion recognition, which is over and above that expected from the individual's cognitive abilities, the poorer emotion recognition of participants with ID results from cognitive deficits that are related to their ID, such as memory, attention and processing ability. In his review of research, he cites a number of studies which have found no significant differences between participants with ID and child control groups matched on estimated cognitive ability. He notes that these studies share the common factor of using emotion tasks that make fewer cognitive demands on participants, specifically in relation to information processing.

Research with adults with ID has found that having additional contextual information was associated with greater accuracy at identifying emotions (McKenzie et al., 2001). This may be because adults with ID are able to make better use of relevant contextual information and ignore extraneous information than children with ID.

Implications for practice

The results of the present study may help inform universal school-based socio-emotional programmes and other

interventions that are designed to help support the social and emotional development of children by identifying the particular needs of children with ID in relation to emotion recognition. While this study focused on emotion recognition tasks and excluded children with ASD, previous research suggests that the role of context may differ with the nature of the task and the needs of the children. Da Fonseca et al. (2009) found that providing contextual information was only helpful for children and adolescents with ASD in terms of recognising objects, but not emotions. This highlights a need for further research exploring whether contextual information helps or hinders children's recognition on non-emotion as well as emotion tasks.

Limitations

The study had some limitations, the main one being the nature of the stimuli that were used. As static images, their ecological validity was limited when compared with the dynamic, fleeting nature of emotional expression in real life. However, resources which are designed to teach and support emotion recognition often include static images, such as line drawings and photographs (e.g. Wang, 2013), and static materials are frequently used in interventions to improve the emotion recognition of people with ID (Wood & Stenfert Kroese, 2007). It was, therefore, considered important to explore the impact of

differing levels of context of static emotion stimuli on children with and without ID.

A second limitation was that the diagnosis of ID was obtained by parental report in relation to children who were recruited from special educational provision, rather than the diagnosis being confirmed by the researchers. It is, therefore, possible that some of the children in the ID group may not have met the formal diagnostic criteria for ID. Similarly, while information about co-existing conditions was provided by the parents, it is possible that some of the children may have had a condition which is associated with difficulties with emotion recognition, such as ASD, which had not yet been diagnosed.

Research suggests that both cognitive (Moore, 2001) and language ability (Pons et al., 2003) can influence emotion recognition. Cognitive ability, of which language ability and verbal comprehension are components, was not controlled for in the study because, by definition, children with ID have significant impairments in cognitive functioning. As we were interested in whether the emotion recognition of children with ID is influenced by different levels of contextual information in the same way as TD children, to control for cognitive ability would conceptually and statistically be to 'control away' the very effect that our study sought to investigate. Future research

could, however, explore whether the impact of contextual information differs according to the level of cognitive ability of children with ID.

Finally, the relatively small sample size and number of emotion items precluded an examination of the performance of the children by specific emotions. Examining whether the level of contextual information impacts differentially on individual emotions is an important area for future research.

Conclusion

Despite the above limitations, this study offers a first step in identifying a number of areas to be considered in practice and for future research. In terms of research, the study highlights the need for further examination of the relationships between emotion recognition and factors such as the amount of contextual information available, task type, and demand for children with and without ID. Uncovering these relationships will, in turn, help refine the development and provision of interventions to promote the emotion recognition skills of children with ID, as well as TD children.

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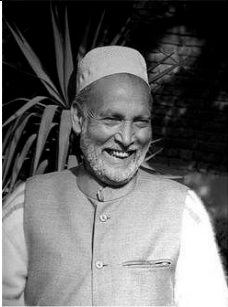
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Table 1: Examples of stimuli for 'Happy' with different levels of contextual cues.

Line Drawing	Photograph with limited context	Photograph with high Context
	  From: http://www.flickr.com/photos/kkoshy/ 2460058549/	 From: http://www.flickr.com/photos/rileyroxx/ 225440099

Note: Stimuli were in colour

Table 2: Scores in the emotion conditions for children with and without ID

	Emotion conditions	
Children with ID	**Range**	**Mean (SD)**
Type of stimuli		
Line drawing (LD)	0-6	4.3 (1.3)
Picture with limited context (LC)	1-7	3.9 (1.6)
Picture with context (WC)	0-7	3.6 (1.7)
Overall score	5-19	11.8 (3.8)
Children without ID		
Type of stimuli		
Line drawing (LD)	2-8	5.2 (1.3)
Picture with limited context (LC)	2-9	5.9 (1.5)
Picture with context (WC)	1-8	5.7 (1.6)
Overall score	7-22	16.8 (3.5)

Table 3: Multi-level model results

Parameter	Value	SE	*t*	*p*
Fixed effects				
Intercept	1.96	0.52	3.75	<0.001
Age	0.16	0.04	4.27	<0.001
LD condition*	0.32	0.22	1.42	0.16
WC condition*	-0.26	0.22	-1.18	0.24
Group	2.52	0.33	7.56	<0.001
LD x Group	-1.07	0.30	-3.55	<0.001
WC x Group	0.03	0.29	0.09	0.93

*Reference category is LC.

Note: LD = Line Drawing, LC = Limited Context, WC = With Context

Figure 1: The patterns of scoring across groups and conditions