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Age-of-actor effects in body expression recognition of children

Petra M.J. Pollux

School of Psychology, University of Lincoln, Brayford Pool, Lincoln LN6 7TS, United Kingdom

A R T I C L E I N F O

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A B S T R A C T

Investigations of developmental trajectories for emotion recognition suggest that both face- and body expression recognition increases rapidly in early childhood and reaches adult levels of performance near the age of ten. So far, little is known about whether children's ability to recognise body expressions is influenced by the age of the person they are observing. This question is investigated here by presenting 119 children and 42 young adults with videos of children, young adults and older adults expressing emotions with their whole body. The results revealed an own-age advantage for children, reflected in adult-level accuracy for videos of children for most expressions but reduced accuracy for videos of older adults. Children's recognition of older adults' expressions was not correlated with children's estimated amount of contact with older adults. Support for potential influences of social biases on performance measures was minimal. The own-age advantage was explained in terms of children's reduced familiarity with body expressions of older adults due to aging related changes in the kinematics characteristics of movements and potentially due to stronger embodiment of other children's bodily movements.

1. Introduction

The ability to recognise emotional state in others is essential for social interaction and has been associated with better social adjustment, mental health and workplace performance (Carton, Kessler, & Pape, 1999; Nowicki & Duke, 1994). While facial expressions are strong predictors for emotional state, bodily cues such as postural changes and gestures can provide critical information when facial cues are insufficient or when a person is viewed from a distance (Atkinson, Dittrich, Gemmell, & Young, 2004; Dael, Mortillaro, & Scherer, 2012; De Gelder, 2009; Mortillaro & Dukes, 2018) and can modulate judgements from unambiguous facial or vocal cues when perceived at the same time (Aviezer, Hassin, Bentin, & Trope, 2008; Aviezer, Trope, & Todorov, 2012; Jessen & Kotz, 2011; Meeren, van Heijnsbergen, & de Gelder, 2005; Yeh, Geangu, & Reid, 2016). Moreover, body expressions have been found to activate action-related neural structures, suggesting their role in judging action intentions and response preparation (De Gelder et al., 2010; De Gelder, De Borst, & Watson, 2015).

Consistent with the developmental trajectory in facial expression recognition (Gao & Maurer, 2010; Thomas, De Bellis, Graham, & LaBar, 2007; Widen, 2013), the ability to categorise emotions based on bodily cues develops in early childhood and reaches adult levels of performance in early adolescence (Missana, Atkinson, & Grossmann, 2015; Mondloch, 2012; Nelson & Mondloch, 2017; Nelson & Russell, 2011; Rajhans, Jessen, Missana, & Grossmann, 2016; Ross, Polson, & Grosbras, 2012; Zieber, Kangas, Hock, & Bhatt, 2014a, 2014b). Sensitivity to emotions in body expressions has been demonstrated at early stages of development in ERP (event-related potentials) studies, where neural responses of eight month old infants to images of body expressions were characterised by emotion-specific modulations (Missana et al., 2015) and neural responses to images of facial expressions were modulated by preceding images of incongruent body expressions (Rajhans et al., 2016). Behavioural studies demonstrate that three to five year old children are able to name basic emotions (happy, sad, angry and fear) from bodily cues (Nelson & Russell, 2011) and that eight year old children are sensitive to influences of incongruent body expressions when naming emotions based on facial expressions, although this sensitivity seems to depend on the similarity between the emotions expressed by face and body (e.g., more interference was found for naming sad faces when combined with fearful body expressions than with happy body expressions (Mondloch, 2012)). Ross et al. (2012) further showed that performance in naming emotions from body expressions displayed in Point Light Displays (PLDs) increases rapidly in childhood until approximately eight to nine years of age, at which point the improvements are more gradual until early adolescence when their performance becomes more comparable to that of adults (Ross et al., 2012).

Studies investigating developmental trajectories in body expression

E-mail address: ppollux@lincoln.ac.uk.

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perception have mainly used displays of body expressions enacted by young adult actors, yet the majority of children socialise most frequently with other children once they are attending school. The present study investigates if children's ability to recognise body expressions is sensitive to the actor's age, specifically whether their recognition of other children's body expressions is enhanced compared to those of older actors. Own-age advantages have been shown to characterise face identity recognition, reflected in faster processing and better memory for own-age faces, which has previously been attributed to enhanced salience and stronger engagement of self-referential processing (Ebner et al., 2013; Fölster, Hess, & Werheid, 2014). Similar asymmetric effects of age cues in facial stimuli have been observed for facial expression recognition (Malatesta, Izard, Culver, & Nicolich, 1987; Riediger, Voelkle, Ebner, & Lindenberger, 2011;) although not consistently (e.g. Ebner et al., 2013; Ebner, He, & Johnson, 2011; Ebner, Johnson, & Fischer, 2012). A few studies have associated emotion-specific age-effects with social category biases, such as the proposed association between negative expressions and older age, reflected in enhanced performance for angry older faces (Ebner & Johnson 2009), or with enhanced positive evaluation of younger adult faces, reflected in faster responses to young happy faces (Craig & Lipp, 2018).

To investigate if age of a person expressing an emotion influences observers' recognition of their body expression, we previously presented body expression PLDs of actors from different age groups (children, young adults, older adults) to participants of the same three age groups (Pollux, Hermens, & Willmott, 2016). Given that aging changes kinematic characteristics in movements for maintaining postural stability (Maki & McIlroy, 2006) and velocity of movement tends to decline (Seidler et al., 2010), it was assumed that bodily cues of older adults (e.g. slower movements and fewer lower body movements) would be less familiar and informative for children's emotion judgements compared to those enacted by child actors. The results showed, however, that children's performance, while consistently reduced compared to adult observers, was not selectively enhanced for PLDs of child actors. The present study explores whether the absence of age effects in this study may have been associated with the impoverished information provided in PLDs of body expressions. One notable characteristic of the PLDs was that kinematic cues in the body expressions were not sufficient for discerning the age of the actors. Without the presence of other cues about a person's age, the association between age and age-specific postural and kinematic features may not have been made and this information may therefore not have been used.

To explore this explanation, children and young adults in the present experiment are presented with videos of whole body expressions enacted by the same actors as those used for creating the PLDs in Pollux et al. (2016). It is assumed that information from form and texture (e.g. body shape, clothes and skin) will facilitate faster and more automatic processing of the actor's age. The importance of relative speed in processing of age and emotion cues for age to influence emotion judgements, has been shown in studies investigating this relationship for emotional faces (Craig & Lipp, 2018; Craig, Lipp, & Mallan, 2014). Craig and Lipp (2018) found that age judgements were faster than emotion judgements and that age-related social biases influenced emotion judgements whereas age judgements were unaffected by facial expression. Given the presence of multiple cues for age in body expression videos from form, texture and movement, it is anticipated that age is more likely to influence body expression judgements. Children's body expression categorisation may be selectively facilitated for body expressions in videos of child actors, assuming that child-viewers are more familiar with child-specific kinematic characteristics in movements (e.g. fluent and fast) and emotional gestures (e.g. stomping on the floor for anger, jumping for joy) than with emotional body expressions of older adults. Performance of young adult viewers may be characterised by social biases similar to those observed for facial expression categorisation (Craig & Lipp, 2018; Ebner & Johnson, 2009) assuming that this effect generalises to social cues other than facial expressions.

A factor that may influence children's ability to categorise body expressions of older adults is their perceptual experience with age-related changes in postural and kinematic characteristics. A few findings suggest that exposure to aging faces reduces own-age advantages in face memory performance (Harrison & Hole, 2009; Wiese, Komes, & Schweinberger, 2012; Wiese, Wolff, Steffens, & Schweinberger, 2013). Wiese et al. (2013) showed for example that face memory of geriatric nurses was not characterised by an own-age advantage, whereas memory performance of control participants (who had infrequent contact with older adults) was enhanced for own-age faces compared to faces of older adults (Wiese et al., 2013). Our previous study (Pollux et al., 2016) found limited support for the idea that children's contact with older adults (measured with ratings for estimated contact with people of different age groups) improves accuracy of body expression recognition for PLDs of older adults (a correlation was only for the youngest children). A similar measure for contact will be included in the present study to investigate if this result is the same when age can be discerned easily in the body expression videos.

To summarise, the present study investigates; *i)* whether children's body expression recognition is characterised by an own-age advantage when age-cues are unambiguous in body expression videos; *ii)* whether children's ability to recognise body expressions of older adults is associated with frequency of contact with older adults.

2. Methods

2.1. Participants

Forty-two young adults (27 males, age = 22.8 ± 1.2 years (Mean ± SE (standard error); 15 females, age = 21.9 ± 0.28 years) were recruited via the Subject Pool of the School of Psychology at the University of Lincoln. Children (56 boys and 63 girls) aged between 6 and 10 years old (7.7 ± 0.12 years), were recruited and tested during a 'Summer Science' week organised by the School of Psychology. The sample size for children was determined by the number of children who participated in the Summer Science week. Given that conceptual understanding of certain emotional labels may be too limited in younger children to conduct the task (Widen, 2013), children younger than 6 years old were not included. All children who participated in the summer science week were provided with a token after each experimental task which could be used for access to different games organised during the day.

Informed written consent was obtained from the young adult participants and from the parents of the children. All participants had normal or corrected to normal vision. Ethical approval was obtained from the School of Psychology Research Ethics Committee, University of Lincoln. All procedures complied with the British Psychological Society "Code of Ethics and Conduct" and with the World Medical Association Helsinki Declaration as revised in October 2008.

2.2. Materials

Body expression videos: Thirty-six clips of amateur actors enacting whole body expressions of six expressions (happy, sad, anger, fear, surprise and disgust) were recorded in a large room in front of a green screen attached to a large frame reaching from ceiling to floor. The camera (Nikon D90, resolution 1280 × 720 pixels) was positioned 2 m in front of the actors (frontal viewpoint recordings). A performance area was marked on the floor to ensure that movements were captured by the camera. Amateur and professional actors were recruited at the University of Lincoln and in the local community. Actors consisted of 2 children (boy = 8 years, girl = 9 years), 2 older adults (woman = 72 years, man = 74 years) and 2 young adults (woman = 21 years, man = 21 years). Informed consent was obtained from all actors and from the parents of the children. A professional theatre and film director/actor (Ben Keaton) was approached to direct the performance of the amateur actors. Each enactment of a body expression started and finished in a neutral body position, with legs slightly apart and arms resting to the side of the body. Actors were encouraged to direct their emotional expression to the camera with their whole body. Scenarios were used (Atkinson et al., 2004; Wallbott, 1998) to ensure that the videos displayed high intensity expressions. The director outlined the scenarios and encouraged actors to imagine how they would feel in the situation described for each recording. No other instructions were given. Scenarios varied slightly for children and adults to ensure relevance of the theme (e.g. for 'hot anger' a driving situation was used for adults and false accusations by parents about the cause of a fight between the child and a friend). All recordings were shorter than 10 s. Several recordings were made for each expression (varying between 2 and 6 recordings). Selection of the final stimulus set (by the author) was guided by the intensity of the expression and the presentation of emotion-specific postural changes and gestures (e.g. jerky, fast arm movements for anger or upward arm/hand movements for happy (e.g., Dael et al., 2012; Pollux, Craddock, & Guo, 2019).

The recordings were edited (Adobe Premier Pro) to reduce the length of the videos to 2 s, displaying actors from 2 s before the apex until the apex of the emotional expression. The apex was chosen based on the presence and visibility of emotion-specific postural changes and gestures in the video. The final frame (apex) was selected by the author. Each video (25 fps) was presented in grey-scale and the background was changed to grey. Faces were pixelated in all frames of each video to ensure that facial expression cues were not visible. Videos were presented in the centre of the screen at a distance of approximately 60 cm from the viewer (video frame size 15° * 22.5° visual angle). The size of the actors on the screen varied between 9.5° and 13° visual angle.

Contact questionnaire (adapted from Ebner & Johnson, 2009): For Question 1 participants were required to rate contact with older adults (>65 years) on a scale varying from 1 (never) to 10 (every day). The formulation of the question emphasised face-to-face contact (e.g. for child participants completed by parents: "*How often does your child have personal contact (i.e. face to face) with older adults)?*". The amount of contact was defined for each intermediate rating value: 1 = never, 2 = less than once per year, 3 = on average once per year, 4 = on average twice per year, 5 = on average three to four times per year, 6 = on average once every two months, 7 = on average once per month, 8 = on average once per week, 9 = on average 2–3 times per week, 10 = every day. For Question 2, participants were asked to provide an estimate of the average duration per contact in hours and minutes. The answers to Question 1 were multiplied with the answers to Question 2 for each participant to obtain a 'Contact score' as an estimate for contact.

2.3. Procedure

The experiment was created using Psychopy2 and presented on a laptop (HP Pavilion TouchSmart15, screen-size 15.6-inch, resolution 1366 * 768 pixels). The procedure for recording responses was different for adults and children: Adults entered their own responses whereas children gave their responses verbally, which were entered by the experimenter. The reason for verbal responses of children was to ensure that children focused on the task and were not distracted by trying to respond as fast as possible. Each trial started with the word 'ready' presented at the centre of the screen until the space bar was pressed. The video was then presented. For adults, presentation of the video was followed by a screen showing all six response options (happy, sad, fear, anger, disgust and surprise) including the corresponding response key for each response. The spatial locations of emotion labels on the screen and the label-response key mapping were the same for all trials to limit working memory load for adult participants. After adult participants had entered their response, the word 'ready' appeared on the screen again to indicate the next trial. The same six response options were presented on screen for the children after presentation of the video (without the corresponding response keys). Children were required to give their choice verbally and their responses were entered by the experimenter by pressing the corresponding response key. The 'ready' screen then appeared again until the experimenter pressed the space bar to start the next video. Each video was presented once in a randomised order. The experiment was self-paced and no time-limit was specified in advance. It was explained that the task could be paused after a response was entered. All participants were encouraged to give the answer that first came to mind (i.e. their 'first impression').

Children were introduced to the emotional labels before the task. Six slides containing cartoon figures with high intensity facial expressions were presented and children were asked to label the expression with the following question: "What are they feeling?". The intended expression label or a synonym was mentioned by all children for all six expressions. If a synonym was used, the experimenter would explain that the emotional label used in the task was similar to the label given by the child. Parents who requested to be present during the experimental task were seated behind the children to avoid distraction. After completion of the experiment, young adults answered the contact questions and parents completed the questionnaires for the children. Research assistants received training before the Summer Science week on how to encourage children to maintain attention during experiments.

3. Results

All analyses were conducted using SPSS. Children were allocated to one of three age-groups to ensure relatively equal group sizes: Six year old children (n = 44), 7/8 year old children (n = 40) and 9/10 year old children (n = 35). Initial comparisons of the combined age-groups in terms of overall accuracy for body expression responses (percentage correct) showed no significant difference between 7 and 8 year old children [$t(42) = 1.6$; $p = 0.1$, *Cohen's* $d = 0.62$] or between 9 and 10 year old children [$t(33) = 0.45$; $p = 0.65$, *Cohen's* $d = 0.2$].

3.1. Body expression recognition: accuracy

Percentage correct responses were analysed using ANOVA with Age-actor (child actors (CA), young adult actors (YAA), older adult actors (OAA)) and Expression (angry, sad, fear, happy, disgust, surprise) as within subject factors and Age-group (adults, 9–10 years, 7–8 years, 6 years) as the between subject factor. Greenhouse-Geisser and Bonferroni corrections were applied where appropriate.

Significant effects were found for Age-group [$F(3,157) = 62.3$; $p < 0.001$, $\eta^2_p = 0.54$], Age-actor [$F(2,314) = 170.7$; $p < 0.001$, $\eta^2_p = 0.52$] and Expression [$F(5,785) = 73.8$; $p < 0.001$, $\eta^2_p = 0.32$, Fig. 1]. Performance of adults was higher compared to all children groups (*p's* ≤ 0.001) and accuracy of 7/8 and 9/10 year old children was higher compared to 6 year old children (*p's* ≤ 0.04). Accuracy for happy expressions was higher compared to angry, disgust and sad expressions (*p's* < 0.001), and accuracy for fear and surprise was lower compared to all other expressions happy>angry/disgust/sad>fear/surprise: (*p's* < 0.001). Significant interaction effects were found for Age-group × Age-actor [$F(6,314) = 20.8$; $p < 0.001$, $\eta^2_p = 0.28$, Fig. 2], Age-actor × Expression [$F(10,1570) = 37.4$; $p < 0.001$, $\eta^2_p = 0.19$] and for Age-actor × Age-group × Expression [$F(30,1570) = 1.8$; $p = 0.008$, $\eta^2_p = 0.034$, Fig. 3]. The effect of Age-group × Expression was not significant [$F(15,785) = 2.2$; $p = 0.09$, $\eta^2 p = 0.004$].

Further analysis of the three-way interaction showed that the effect of Age-group was different for the three Age-actor conditions: For videos of child actors, significant differences between age groups were only observed for fear: Adults >8–10 years>6 years (*all p's* ≤ 0.05). In contrast, accuracy tended to increase with age for most expressions in videos of young adult actors and older actors (see Fig. 3): For videos of young adult actors, accuracy increased gradually with age for fear and happy expressions (*fear*: adults >7–10 years >6 years (*p's* ≤ 0.05); *happy*: adults >6–8 years (*p's* ≤ 0.013)), whereas accuracy for sad expressions was similar for all children (adults >6, 7/8, and 9/–10 years; *p's* ≤ 0.006). For videos of older adults, a gradual increase with age was observed for angry, sad, happy and surprise [*angry*: adults >7/8 and 9/

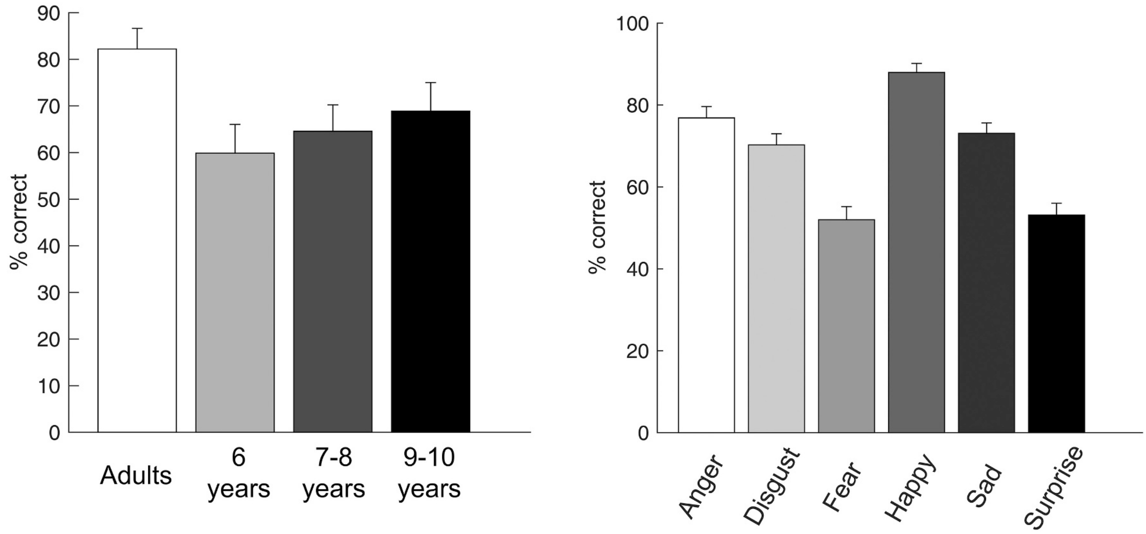

Fig. 1. Left: Accuracy (% correct) as a function of Age-group of participants. Right: Accuracy (% correct) as a function of Expression. Including standard error bars.

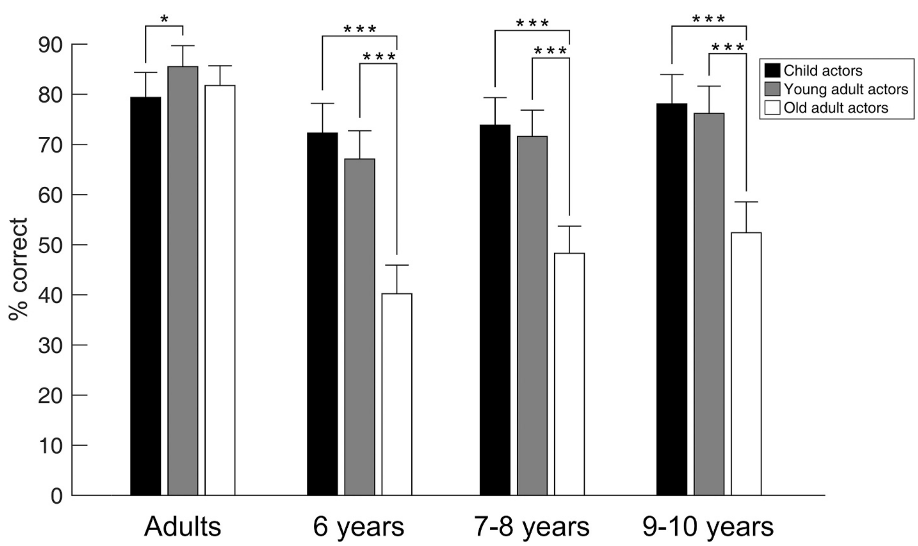

Fig. 2. Accuracy (% correct) as a function of Age-group and Age-actor (CA = Child actor, YAA = Young adult actor, OAA = Older adult actor) (including standard error bars).

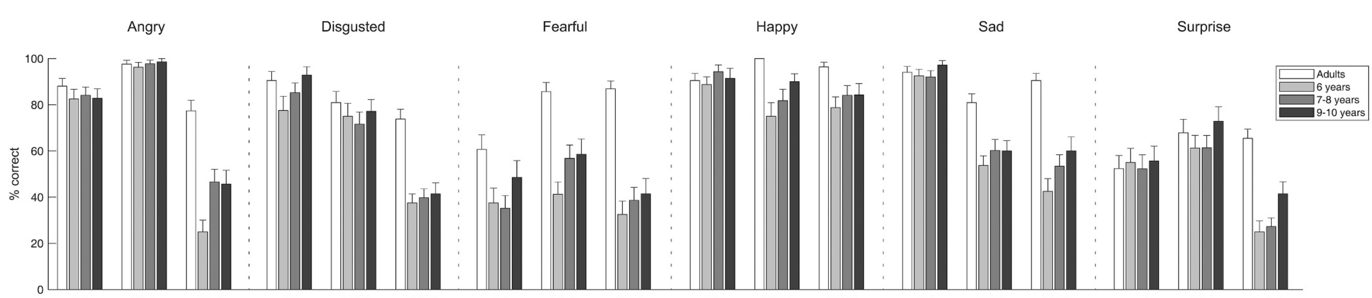

Fig. 3. Accuracy (% correct) as a function of Age-group, Age-actor (CA = Child actor, YAA = Young adult actor, OAA = Older adult actor) and Expression (Angry, Disgusted, Fearful, Happy, Sad and Surprise) (including standard error bars).

10 years >6 years (*p's* ≤ *0.049*); *sad*: adults >6–10 years (*p's* < *0.001*) + 9/10 years >6 years (*p* = *0.045*); *happy*: adults >6 years (*p* = *0.013*); *surprise*: adults >6–10 years (*p's* < *0.001*) + 9/10 years >6 years (*p* = *0.05*)], whereas performance was comparable for the three groups of children for fear and disgust [adults >6–10 years (*p's* < *0.001*)].

Additional analysis showed that the effect of Age-actor varied across expression and was more pronounced for children. For adult viewers, accuracy was highest for videos of angry young adult actors (YAA > OAA; *p* = *0.001*), highest for videos of disgust and sad expressed by child actors (CA > OAA; *p's* ≤ *0.014*) and highest for fear expressed by young and older actors (YAA/OAA > C; p's $\leq$ 0.001). In contrast, for all three groups of child viewers, accuracy was significantly lower for videos of older adults for anger, disgust, sad and surprise, either compared to videos of child actors only (Sad, CA > YAA/OAA; *all* p's $\leq$ 0.001) or compared to videos of both young adult and child actors (angry, disgust surprise: YAA/CA > OAA, *all* p's $\leq$ 0.04). Age-actor effects were not significant for fear and happy expressions for child viewers.

3.2. Categorisation errors for videos of older adult actors

To further explore the responses of young adults and children for body expressions enacted by older adult actors, an analysis of frequency distributions was used (Chi-square test association, separately for each Expression and Age-actor condition). Responses of children were combined for this analysis. The results showed that the response given to body expressions of older adult actors was significantly associated with Age-group (adults vs. children) for Angry, Disgust, Fear, Sad and Surprise ($\chi^2 \geq 29.1$; p's < 0.001). Fig. 4 shows that compared to adults, children were more likely to select happy for surprise expressions and surprise for fearful and angry expressions when viewing videos of older adult actors. For sad and disgust, children's responses were more evenly distributed over the unintended expression (e.g. angry, fear and happy for the intended expression disgust). The associations found for videos of older adult actors were not significant for videos of young adult actors or child actors, suggesting that the distributions of responses were comparable across age-group for these videos.

3.3. Contact

Average percentage of correct responses was calculated for videos of older actors. Correlation analysis (Spearman rho to accommodate non-normal distributions of contact values) was used to investigate if the estimated amount of contact with older adults (Contact score = Answer Q1 * Answer Q2) was associated with accuracy for categorisation of emotions expressed by older adults, separately per age-group. This analysis revealed no significant results (Table 1).

4. Discussion

The results of the present study revealed that while body expression recognition was lower for children than for adults, children's

Table 1
Contact scores: Estimated values for frequency of face-to-face contact with older adults multiplied by the estimated average duration per visit (in hours (standard errors in parentheses)).

	Young adults	6 years	7/8 years	9/10 years
Frequency value	3.8 *(0.2)*	7.7 *(0.3)*	8.0 *(0.2)*	8.5 *(0.2)*
Duration (hours)	3.2 *(0.3)*	4.5 *(0.7)*	5.8 *(1.2)*	4.2 *(0.4)*
Contact score	11.7 *(1.0)*	34.1 *(5.4)*	46.4 *(9.1)*	34.9 *(3.7)*

Frequency values: 1 = never, 2 = less than once per year, 3 = on average once per year, 4 = on average twice per year, 5 = on average three to four times per year, 6 = on average once every two months, 7 = on average once per month, 8 = on average once per week, 9 = on average 2–3 times per week, 10 = every day. Contact score = Frequency value * Duration.

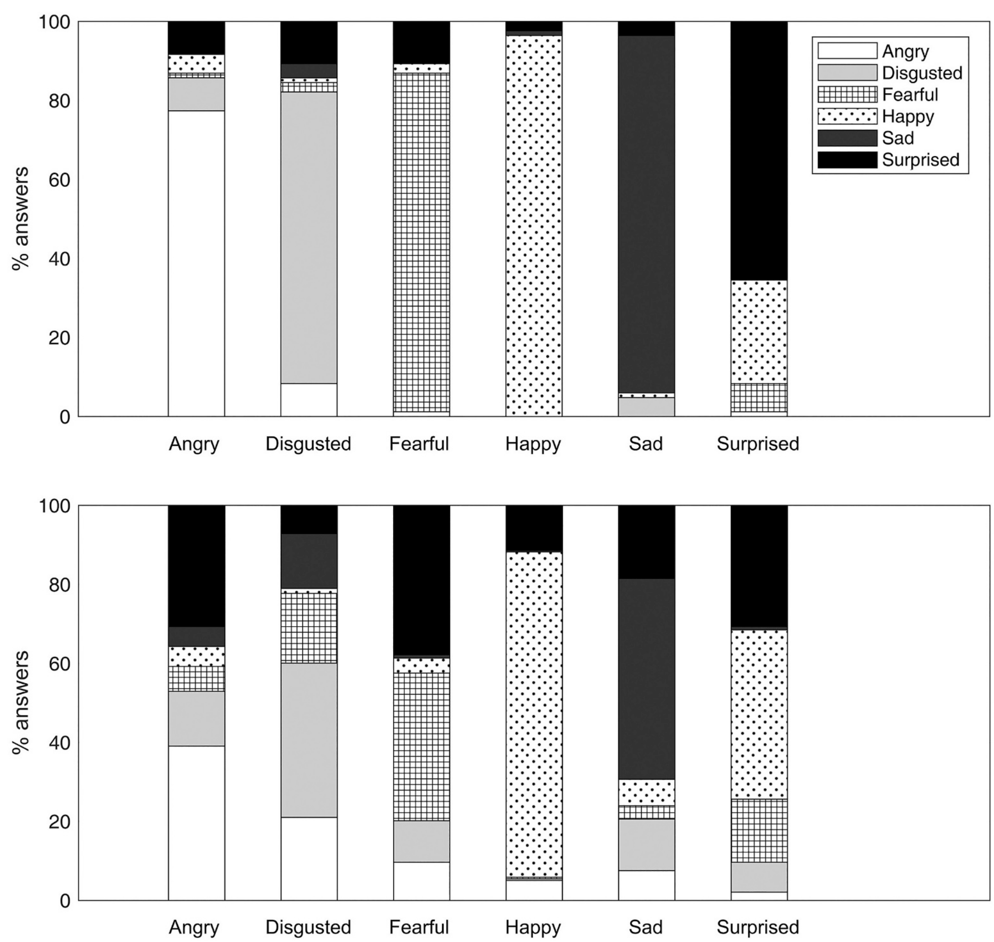

Fig. 4. Percentage of answers given by Adults (top) and Children (bottom), collapsed over Age-group of children in response to videos of older actors for each intended expression (Angry, Disgusted, Fearful, Happy, Sad, Surprised).

categorisation responses were more accurate for child actors. Reduced accuracy for videos of older actors was strongest for younger children and gradually improved with age for some expressions. Estimated contact with older adults was not associated with body expression categorisation accuracy or response times, suggesting that the own-age advantage observed in child viewers is not strongly influenced by children's amount of face-to-face contact with older adults in the present study.

The observation that actor's age influenced children's body expression recognition when videos are used supports the idea that this effect is dependent on the presence of sufficient age cues for rapid processing of age (Craig & Lipp, 2018). In contrast to the limited age cues provided in body expression PLDs (Pollux et al., 2016), the age information inferred from texture and form (e.g. body shape, clothes and skin) in the videos may have been processed fast enough to influence observers' body expression judgements. The influence of age was reflected in children's enhanced performance for videos of children compared to those of older adults for the majority of emotions, which seems to align with the assumption that children may be more familiar with characteristics of children's body expressions compared to those of older adults. Emotional body expressions vary in terms of postural changes and limb movements (Atkinson et al., 2004; Dael et al., 2012) and velocity of these movements can provide important information for emotion discrimination (Atkinson et al., 2007; Gunes, Shan, Chen, & Tian, 2015). In most videos, the movements of child actors were faster and more pronounced compared to those of older adult actors. For instance, for sadness children tended to move their whole body, whereas older adults only tended to lean their heads forwards. For happy expressions, children tended to jump up and down whereas older adults only raised their arms. The differences in kinematic characteristics between child- and older adult actors may have been particularly confusing for children in expressions that are characterised by fast and jerky emotion-specific gestures, such as fear and anger. In contrast to child- and young adult actors expressing anger, changes in body posture of older actors were less pronounced and notably slower. Without additional information from facial expressions these bodily movements may have been difficult to interpret for children, which could explain the low accuracy levels for these expressions. The relative importance of facial and bodily cues for children's judgement of different emotions may require further investigation. For instance, children's recognition of fearful expressions was low for all videos and not influenced by the actor's age, suggesting that facial cues may be more important for children's ability to recognise fear in people of all ages. In contrast, accuracy for happy expressions (also unaffected by the actor's age) was high for all age-groups, suggesting that typical bodily cues for happy were more informative for children in all videos, whether the actors' movements were fast or slow. The finding that the own-age advantage observed for the other four emotions was not found when body expression PLDs were used (Pollux et al., 2016) suggests that knowledge of age-specific kinematic characteristics only facilitates children's recognition of other children's expressions when age cues are unambiguous and age can be processed rapidly. Future studies may be needed to confirm this assumption in a more systematic investigation comparing the relative speed of age and emotion judgements in PLDs and videos of body expressions (e.g. Craig & Lipp, 2018).

Recognition of adult facial expressions has previously been suggested to be influenced by social group biases, reflected in selectively enhanced performance for negative older adult faces or for happy young adult faces (Craig & Lipp, 2018; Ebner & Johnson, 2009). The findings of the present study do not support the idea that similar biases influence body expression recognition. While stereotypes and negative attitudes against older adults have been reported in the age range of the children participating in the present study (e.g. Bergman, 2017), the trend in children's performance on the body expression recognition task was not consistent with any influences of social group biases. A few factors may require consideration before excluding potential influences of social biases in body expression recognition. Firstly, bodily movements and gestures in body expressions are generally associated with greater variability across individuals (Atkinson et al., 2004; Dael et al., 2012) compared to individual differences in emotion-specific facial cues of posed emotional faces, which may have increased variance and limited sensitivity of task measures. Second, the use of videos (as compared to stills) may have introduced additional variability in the temporal dynamics of body expression recognition. For instance, while each video ended with the apex of the expression, the build-up to the apex may have been slower in some videos (e.g. fear) than others (e.g. happy). Further investigations using still images may be able to confirm whether potential influences of social biases are restricted to facial expressions only.

One factor that was suggested to reduce children's own-age advantage was the amount of contact children have with older adults. Given that the own-age advantage was observed despite children's regular face-to-face contact with older adults (averaging on once per week) and the weak correlations between contact and behavioural measures, it is not likely that the amount of contact is a strong predictor for children's ability to recognise older adults' body expressions. This finding could potentially be associated with the measure used for contact. First, exposure to body expressions of older adults is not likely to be restricted to face-to-face contact and may have been obtained via other perceptual experiences, such as in random unscheduled contact or by watching films or playing video games. Second, the quality or the subjective relevance of the contact with older adults, instead of the amount of contact, may be a stronger predictor for children's learning about the subtle differences between body expressions of younger and older adults. For instance, ageism in children has been found to be particularly reduced for those children who have a very good relationship with their grandparents, resulting in more positive feelings towards older adults in general (Flamion, Missotten, Marguet, & Adam, 2019). Similarly, children's learning about the characteristics of older adults' body expression may be facilitated if the contacts they have are important or rewarding for the child. To investigate the role of familiarity and exposure reliably, a more in-depth analysis of children's contact with older adults may be required before the influence of contact can be conclusively excluded.

A different factor that could potentially have influenced children's enhanced recognition of children's body expression may be the differences in children's embodiment of emotions expressed by adults and children (Cook, 2016; Cook, Blakemore, & Press, 2013). Embodied emotion accounts suggest an overlap in neural structures involved in expression and perception of emotion (Barsolou, 1999; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Wilson-Mendenhall, 2017). Observing actions performed by another person has been shown to evoke activity (motor resonance) in one's own motor system (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Iacoboni et al., 1999) which tends to increase when the observed motor ability is within the motor skill repertoire of the observer (Cook, 2016; Cook et al., 2013). For instance, overlap in motor ability has been suggested to facilitate social perception in people with Autism Spectrum Disorder (ASD), reflected in associations between the severity of kinetic abnormalities and difficulties in social interaction skills (Cook, 2016; Cook et al., 2013). Neuropsychological findings further show that impairments in emotion recognition are associated with motor disorders, such as Parkinson's disease (Argaud, Vérin, Sauleau, & Grandjean, 2018) or myotonic dystrophy (Lenzoni et al., 2020) and ratings of facial expressiveness in Parkinson's Disease has been found to be predictive for the ability to recognise facial expression (Marneweck, Palermo, & Hammond, 2014). Based on these converging findings, it may be that simulation of body movements is enhanced when children observe other children due to the overlap in motor skills, thereby facilitating recognition of other children's body expressions. While speculative at this point, the potential contribution of enhanced simulation could be investigated further in children by exploring associations between body expression recognition and physiological responses associated with simulation, such as motor resonance (Cross, Hamilton, & Grafton, 2006).

To conclude, the results of the present study reveal that body expression recognition of children is characterised by an own-age advantage for several emotions when body expression videos are used instead of PLDs (Pollux et al., 2016), suggesting that age information needs to be processed rapidly for influences of age on body expression judgements to be revealed. The own-age advantage for children could not be explained by the amount of contact with older adults and children's overall expression categorisation performance did not seem to be influenced by social biases. Issues with the sensitivity of the measures were raised and alternative approaches for future studies were proposed to investigate the role of familiarity, contact and embodied emotion in the own-age advantage observed in children's body expression categorisation skills.

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Declaration of competing interest

There are no known conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.actpsy.2021.103421.

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