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Putting motion in emotion: Do dynamic presentations increase preschooler's recognition of emotion?☆

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ABSTRACT

In prior research, preschoolers were surprisingly poor at naming the emotion purportedly signaled by prototypical facial expressions—when shown as static images. To determine whether this poor performance is due to the use of static stimuli, rather than dynamic, we presented preschoolers (3–5 years) with facial expressions as either static images or dynamic audiovisual clips. Dynamic clips presented face alone (Study 1, $N = 48$) or face, body movement, and vocal intonation (Study 2, $N = 72$). Contrary to expectations, dynamic presentation did not increase children's naming of the emotion in either study and decreased it in Study 1.

1. Introduction

Preschoolers have proven to be far less likely than adults to label emotional facial expressions in the manner expected (Denham, 1998; Gates, 1923; Vieillard & Guidetti, 2009; Walker-Andrews, 1986; Widen & Russell, 2003, 2010). Around their third birthday, children reliably apply only two emotion labels to all emotions expressed by faces, a positive label (*happy*) and a negative label (either *sad* or *angry*) (Widen & Russell, 2008); many of their responses appear to be "errors".

According to some accounts, children's responses, though not like adults', are systematic and predictable. Their labeling "errors" reveals how they understand emotions (Gao & Maurer, 2009; Widen & Russell, 2003). Children use only two labels because they understand all emotions in terms of pos-

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itive and negative valence rather than in terms of discrete, adult-like emotional categories (Widen & Russell, 2008).

According to other accounts, children's "errors" conceal their true emotion knowledge. That children make "errors" is in stark contrast to the widespread theory that facial expressions convey discrete and universally identifiable emotional information to infants (Camras et al., 2002; Serrano, Iglesias, & Loeches, 1995), children (Denham, 1998; Harris, 1989; Izard, 1994), and adults (Ekman, 1973a,b, 1982; Kohler et al., 2004). Proponents of this theory suggest that children's labeling "errors" stem from limitations in vocabulary or the presentation of flawed stimuli. A series of studies have shown vocabulary restraints to be an unlikely cause of children's poor performance (Balconi & Carrera, 2007; Nelson & Russell, 2011; Nelson, Hudspeth, & Russell, submitted for publication; Reichenbach & Masters, 1983; Widen & Russell, 2004), leaving open the possibility that the stimuli used are inadequate.

One suggested explanation for children's errors is that the static facial expressions typically presented lack the dynamism of expressions seen in daily life (Vieillard & Guidetti, 2009; Caron, Caron, & Meyers, 1985; Eibl-Eibesfeldt, 1970; Fogel, 1993; Flavell, 1985). Prior research shows that infants gaze longer at dynamic emotional facial expressions than static ones (Wilcox & Clayton, 1968), and adults are more likely to select the correct target label when presentations are dynamic rather than static (Ambadar, Schooler, & Cohn, 2005;Wehrle, Kaiser, Schmidt, & Scherer, 2000). It is possible that preschoolers' performance labeling discrete emotions would be improved by presenting them with richer, dynamic stimuli—a possibility that, to our knowledge, has not been tested.

In the present research, we pursued the idea that young children are more likely to attribute the target label to dynamic expressions, rather than static. We focused on the four emotions of happiness, sadness, anger, and fear because young preschoolers typically produce labels for these emotions earliest (Widen & Russell, 2003, 2008). In Study 1, we compared children's labeling of static facial expressions to their labeling of dynamic ones. In Study 2, we compared children's labeling of static facial expressions to their labeling of dynamic expressions that included facial, postural, and vocal cues. In both studies, the dependent variable was children's freely produced answer to the question "how is this person feeling?" We chose a free-labeling format over forced-choice in order to examine children's spontaneous rather than forced interpretation of cues. Whereas free-labeling comes close to capturing a child's unprompted categorization of the emotion, forced-choice can result in the endorsement of labels that the child would not generate on their own or even agree with.

In each study, children were shown audiovisual clips and two sets of static photographs in a within-subject design. The Study-created photographs were included in order to compare children's performance labeling the dynamic audiovisual clips to a static version of the apex of the facial expressions shown in the clips. The Standard photographs were chosen because they were from a carefully developed set said to represent the prototypes of universal emotion signals (Ekman & Friesen, 1978) and would allow us to compare our stimuli to the stimuli commonly used in previous research.

2. Study 1

2.1. Method

2.1.1. Participants

Participants were 48 preschoolers (mean age = 43 mos.; SD = 9.5 mos.), with 16 children in each of three age groups: 2 years old (mean age = 32 mos.; SD = 2.5 mos.), 3 years old (mean age = 43 mos.; SD = 4.1 mos.) and 4 years old (mean age = 54 mos.; SD = 3.6 mos.). Each age group included an equal number of males and females and the average parental education level for the sample was a bachelor's degree. All children were fluent in English and tested at child care centers in the greater Boston area. Two adult comparison groups, comprised of undergraduate students, participated as well ($N = 35$; $N = 18$).

2.1.2. Materials

Four audiovisual clips of an approximate standard length (average 7 s) were created, in which a professional female actor, who had over 10 years of acting experience in theater and film, displayed one of the following target emotions: happiness, sadness, anger and fear. She performed the expressions

using her extensive expertise and modeled the expressions after standardized ones used in prior research (Ekman & Friesen, 1978).

2.1.2.1. Audiovisual clips of facial expressions. For each of the audiovisual clips, the actor approached a flower, smelled it and then displayed a facial expression (moving from a neutral face to an emotional face) while speaking (saying the same sentence in each video: "I felt this feeling before; it was just a few days ago"). Only her head was visible while she displayed the expressions and no sound was presented.

2.1.2.2. Study-created photographs. The Study-created set were color photographs of neutrality, happiness, sadness, anger, and fear. These photographs were created by taking the frame of the apex of the actor's facial expression from the audiovisual clip.

2.1.2.3. Standard photographs. The Standard set were black and white photographs of neutrality, happiness, sadness, anger, and fear (Ekman & Friesen, 1978): PF1-5, PF2-16, PF2-4, PF2-30, and PF1-16.

2.1.3. Procedure

All children first underwent a priming procedure to increase the accessibility of the needed emotion labels and to decrease the likelihood that limitations in label accessibility influenced children's performance on the tasks. The experimenter initiated a conversation with the child about feelings, asking questions such as: "Happiness is a feeling, have you ever felt happy?" The labels targeted in the priming session were those that were to be presented in the study (*happiness*, *sadness*, *anger* and *fear*), and children heard each target label twice before participating.

Next, children participated in two counterbalanced blocks of trials: photograph labeling and audiovisual clip labeling. Stimuli were presented on a 12 in. computer screen and children were asked to answer the question "How does she feel?" Children were free to give any label they chose. In the photograph labeling trials, children were shown the two sets of photographs, with the first set presented in its entirety before the second set was shown. The order of set presentation was counterbalanced across children and, within each set the photographs were presented in random order. In the audiovisual clip labeling trials, the presentation of audiovisual clips was also random.

For each set of facial expressions in the photograph labeling procedure, children were first shown the neutral expression associated with the set of photographs and were told "I brought some pictures today of a girl named Alice (the name of the protagonist in the Standard photographs, or Molly, the protagonist in the Study-created photographs). This is what she looks like." For each of the subsequent facial expressions shown, the experimenter told the child "One day, Alice (or Molly) felt like this. How does she feel?" Children could view the photographs for as long as they wished. Children's answers were not corrected, and were mildly praised.

In the audiovisual clip labeling procedure, children were first shown three introductory audiovisual clips of the actor performing normal daily activities in her house, displaying no emotion. Children were asked to label an easily recognizable household object held by the actor in the audiovisual clip (book, apple or hat) to ensure that they were able to produce labels in reference to the audiovisual clips when prompted.

To introduce the emotion audiovisual clips, children were told a story about the protagonist, Molly, who finds a magical flower in her living room. The flower "gives anyone who smells it a feeling." Children were then told that Molly decided to smell the flower "to see how it would make her feel." The audiovisual clip was then played and the actor approached the flower, smelled it, and displayed a facial expression. Only the actor's head and neck were visible. Children were asked "How did Molly feel when she smelled the flower?" Children could view the video clip as many times as they wished. Children's responses were not corrected by the experimenter, but were mildly praised.

2.1.4. Scoring

The adult and child participants generated a variety of labels for the emotions shown and each that did not directly correspond to the target label expected for the emotion categories presented (happy, sad, angry and fear) was evaluated by three independent judges. Judges decided whether a

participant-generated label was a synonym for any one of eight emotion labels (*happy, sad, anger, fear, surprise, disgust, embarrassment, and content*), or if it did not fit into any of the given categories. Emotion labels were accepted for use in this study only if all three judges agreed as to the emotion category. Labels accepted for the emotion categories were: *elated, excited, great, joyful, good*, and *overjoyed* for happiness; *depressed, dismal, sorrowful, and upset* for sadness; *aggressive, frustrated, grumpy, hostile, jealous, mad*, and *rage* for anger; *afraid, frightened*, and *terrified* for fear. Syntax and phrasing were ignored.

In addition, children's responses were further categorized as being of correct or incorrect valence (e.g. labeling sad stimuli as *happy* was coded as a label of incorrect valence, whereas labeling sad stimuli as *angry* was coded as a label of correct valence). The label *surprise* was generated only five times, and because surprise is an emotion category with neither positive nor negative valence, these responses were not categorized as being of correct valence.

2.1.4.1. Adult comparison groups. The emotional content of the audiovisual clips was confirmed with an adult comparison group ($N = 35$). After viewing each clip, participants were asked to answer the question "How did she feel?" with a single label if possible, but were otherwise free to use any label they wanted. Participant agreement as follows: happiness = 100%, sadness = 91%, anger = 94% and fear = 74%.

A second adult comparison group ($N = 18$) was asked to rate the intensity of the emotions displayed in each stimulus. Dependent sample *t*-tests showed that the adult sample rated the Study-created photographs as displaying more intense emotions than the Standard photographs (all p's < .03), but not significantly different from the audiovisual clips (all p's > .25). Although intensity could influence children's performance labeling the Standard photographs, the stimuli we were most interested in comparing, the Study-created photographs and the audiovisual clips, were rated similarly.

2.2. Results and discussion

2.2.1. Introductory audiovisual clips

Children had $48 \times 3 = 144$ opportunities to label the household object shown in the introductory audiovisual clips (book, hat, and apple). On only two occasions did a child mislabel the object shown and no child mislabeled more than one. Two 2-year-old males mislabeled the hat (labeling the coat the actor was wearing instead). Children's responses were clearly not constrained by an inability to label audiovisual clips.

2.2.2. Discrete emotion correct scores

A 2 (sex) × 2 (order of mode presentation) × 2 (order of photograph set presentation) repeated-measures ANOVA showed no main effect of any of these factors on children's performance and no interactions between these 3 factors with the other factors included in the study. Therefore, sex, order of mode presentation and order of photograph set presentation were not included in further analyses.

A 3 (mode of presentation) × 4 (emotion) × 3 (age) repeated-measures ANOVA, followed up with least significant difference (LSD) post hoc tests, showed three main effects. As expected, children's likelihood of using the correct label increased with age, $F(2, 45) = 15.08$, $p < .001$. Also as expected, children's likelihood of using the correct label varied with the emotion presented, $F(3, 135) = 41.56$, $p < .001$). Happy stimuli were labeled correctly most often, followed by sad and angry stimuli, and then by fear stimuli (all p's < .001). In addition, the emotion by age interaction showed that improvement with age varied with emotion, such that improvement was greater for sad and angry than for happy and fear stimuli, $F(6, 135) = 2.39$, $p = .03$ (Fig. 1). The minimal variance seen among the happy stimuli was likely due to a ceiling effect. The minimal variance seen for fear stimuli was not due to a floor effect, although children's performance was low overall (.26), replicating previous research indicating that children do not consistently label fear stimuli until late in the preschool years (Widen & Russell, 2003, 2008). Adults' performance labeling the fear stimuli was also lower than for the other emotions. However, in a secondary analysis that included both child and adult data, this emotion by age interaction remained, $F(9, 237) = 3.57$, $p < .001$, indicating that children's labeling of fear was disproportionately lower than that of adults ($p = .002$).

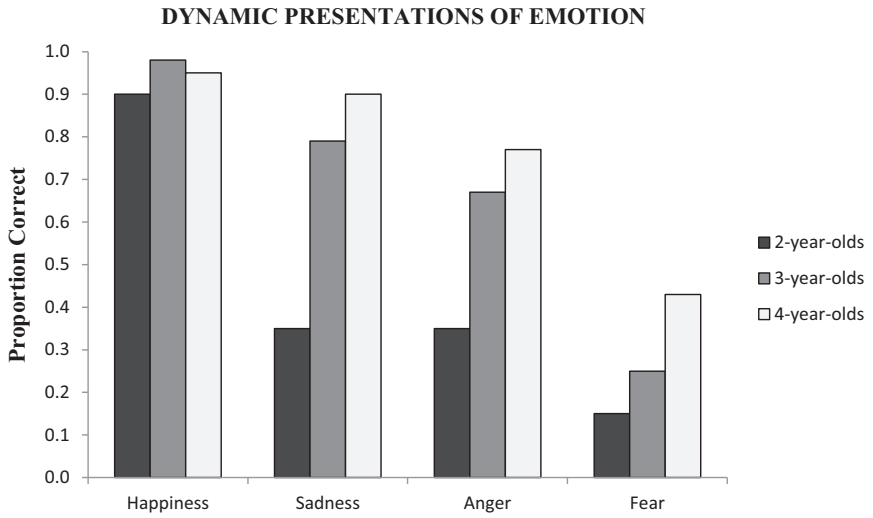

Fig. 1. Proportion of children using the correct discrete label for each emotion, presented by age group, Study 1.

A main effect of mode of presentation, $F(2, 90) = 4.67$, $p = .01$ (Table 1) showed that children used the correct label for the Study-created photographs significantly more often than either the Standard photographs or the audiovisual clips ($p = .003$; $p = .01$, respectively). However, children's labeling of the Standard photographs and the audiovisual clips were not significantly different ($p = .66$), indicating that our static photographs were at least as recognizable as photographs commonly used to represent universal signals of basic emotions.

2.2.3. Valence correct scores

In contrast to the Discrete emotion results, when children's labels were scored correct for valence, there was no main effect of mode, $F(2, 90) = 1.96$, $p = .14$ (although the trend was in the same direction; Table 1). This result might be largely a ceiling effect (mean = .79).

2.2.4. Any emotion vs. non-emotion scores

Dynamic presentations could also increase children's recognition of the stimuli as portraying emotion. All children provided an emotion label for the happy stimuli, and as there was no variance for

Table 1
Proportion of children selecting the target label for each scoring category by mode of presentation.

	Mode of presentation			
	Static photographs		Dynamic audiovisual clips	Mean
	Study-created	Standard		
Discrete emotion correct				
Study 1	$.69_a$	$.59_b$	$.60_b$	.63
Study 2	$.64_a$	$.57_b$	$.66_a$	.62
Valence correct				
Study 1	$.83_a$	$.76_b$	$.79_{ab}$	.79
Study 2	$.76_a$	$.65_b$	$.82_c$	.74
Any emotion				
Study 1	$.83_a$	$.88_a$	$.91_a$	.87
Study 2	$.78_a$	$.71_b$	$.85_c$	.78

Note. Maximum = 1.00. Means in the same row that do not share a subscript differ significantly, $p < .014$ by least significant difference (LSD) comparisons (alpha = .05).

that emotion, it was omitted from this analysis. A 3 (mode) × 3 (emotion) × 3 (age)repeated-measures ANOVA, again contrasting with the Discrete emotion scores, found no effect of mode of presentation. Children's performance producing emotion labels in response to the stimuli provided, as in the Valence Correct labeling, was unaffected by mode of presentation (Table 1).

2.3. Conclusion

The children in this study labeled household objects in the preliminary clips, and they provided emotion labels for the emotionally expressive photographs and clips—labels that were correct as to valence. As in previous studies, however, more than 1/3 of the time the labels were not the ones that adults provide or find correct. Were their "errors" due to the static nature of the stimuli presented? The results were clear: No, adding motion to a facial expression did not increase children's production of the correct label. Correct labeling of the audiovisual clips was equal to that of the Standard photographs and lower than that of the Study-created photographs, which were simply still frames from the clips.

3. Study 2

In their everyday experiences, children see facial expressions not only as moving but also embedded within a context of body posture and vocal intonation. Indeed, children reliably attribute emotion to these latter cues presented on their own (Boone & Cunningham, 1998; De Arth-Pendley & Cummings, 2002; Nelson & Russell, 2011; Nowicki & Duke, 1994). Therefore, a possible explanation for the results of Study 1 may be that facial expressions, even though dynamic, were not embedded in their usual context. With that possibility in mind, we created richer audiovisual stimuli for Study 2, comprised of facial expressions, body posture, and vocal intonation. In addition, to increase the accessibility of the needed emotion labels for children, we used an enhanced priming procedure. Other than these two changes, Study 2 was identical in basic design to Study 1.

3.1. Method

The method in Study 2 was exactly the same as that in Study 1, except where noted below.

3.1.1. Participants

Participants were 72 preschool participants (mean age = 43.2 mos.; SD = 9.4 mos.), evenly divided into three age groups: 2 years old (mean age = 33 mos.; SD = 2.2 mos.), 3 years old (mean age = 42 mos.; SD = 3.7 mos.) and 4 years old (mean age = 55 mos.; SD = 3.3 mos.). Each age group included an equal number of males and females and the average parental education level for the sample was a bachelor's degree. Two adult comparison groups, comprised of undergraduate students, also participated ($N = 25$; $N = 18$).

3.1.2. Materials

Four new audiovisual clips were created (average length 10 s), in which the same professional female actor simultaneously presented three cues to emotion in each video: facial expression (moving from a neutral face to an emotional face), vocal characteristics (varying intonation and pitch, but using the same neutral word content for each video) and body posture and movement (moving from a standing neutral posture to an emotional posture and then exiting the scene using an emotional gait).

3.1.2.1. Audiovisual clips of emotion expressions. In each of the audiovisual clips, the actor approached the flower, smelled it and expressed an emotion using her body and face. As she displayed the expression, she stated, in a matching emotional voice "I felt this feeling before; it was just a few days ago." This sentence was selected because it highlighted the protagonist's feeling, consisted of emotion-neutral content, and was sufficiently long to allow the actor time to emote. After displaying the emotion, the actor exited the scene in a manner that also reflected the emotion (e.g. looking back over her shoulder after displaying fear).

3.1.2.2. Study-created photographs. The same Study-created photographs of the actor's facial expressions that were used in Study 1 were used in Study 2.

3.1.2.3. Standard photographs. The same photographs used in Study 1 were used in Study 2.

3.1.3. Procedure

Participants underwent a more involved, interactive priming procedure to increase the accessibility of the needed emotion labels. Whereas in Study 1, children passively heard the target labels spoken by the experimenter, in Study 2, they were required to produce the four target labels used in the study (happiness, sadness, anger and fear). Children were first asked to verbalize any emotion they could spontaneously think of. Next, for any of the targeted labels that they did not spontaneously generate, children were asked to label their own feeling if they were to experience an emotional event (e.g. "How would you feel if your grandma gave you a puppy?"). If the child did not provide the target label for the emotion event, they were then asked: "What would make you feel X (e.g. happy)?" If the child failed to use the emotion label while describing their own emotional event, the experimenter then asked the child to simply repeat the label (e.g. "Can you say happy?"). All children who participated in the study generated each target emotion label before participating, and a majority (67%) generated the label spontaneously or in reference to an emotional event. These results indicate that children's performance was not limited by a general inability to generate (when prompted) the target labels.

3.1.4. Scoring

Participant-generated labels accepted for the emotion categories were: delighted, elated, excited, good, and joyful for happiness; depressed and upset for sadness; aggressive, grumpy, and hostile for anger; afraid, frightened, terrified, and worried for fear. As in Study 1, children's answers were also categorized in terms of valence.

3.1.4.1. Adult comparison groups. The adult comparison group ($N = 25$) verified the emotional message of the clips: happiness = 100%, sadness = 92%, anger = 80%, fear = 84%.

A second adult comparison group ($N = 18$) was asked to rate the intensity of the emotions displayed in the photographs and audiovisual clips used. As in Study 1, dependent sample *t*-tests showed that, for each emotion, the adult sample rated the Study-created photographs and the audiovisual clips as displaying more intense emotions than those displayed in the Standard photographs (all p's $< .06$). However, the Study-created photographs and the audiovisual clips were rated as displaying similar intensity of emotion (all p's $> .11$).

3.2. Results and discussion

3.2.1. Introductory audiovisual clips

Children had $72 \times 3 = 216$ opportunities to label the household object shown in the introductory audiovisual clips (book, hat, and apple). On only three occasions did a child mislabel the object shown, and no child mislabeled more than one introductory audiovisual clip. Two 2-year-old males mislabeled the hat audiovisual clip (labeling the coat the actor was wearing instead) and one 2-year-old male refused to label the apple.

3.2.2. Discrete emotion correct scores

A 2 (sex) $\times$ 2 (order of mode presentation) $\times$ 2 (order of photograph set presentation) repeated-measures ANOVA showed no main effects of any of these factors on children's performance and no interactions between these variables and the other factors included in the study. Therefore, sex, order of mode presentation and order of photograph set presentation were not included in further analyses.

A three-way repeated-measures ANOVA, 3 (mode of presentation) $\times$ 4 (emotion) $\times$ 3 (age) found, as in Study 1, that children chose the correct emotion label significantly more often with age, $F(2, 69) = 20.89$, $p < .001$. Children's performance also varied with the emotion presented, $F(3, 207) = 74.68$, $p < .001$, with labeling performance ordered from highest to lowest as follows: happiness, sadness, anger, and fear.

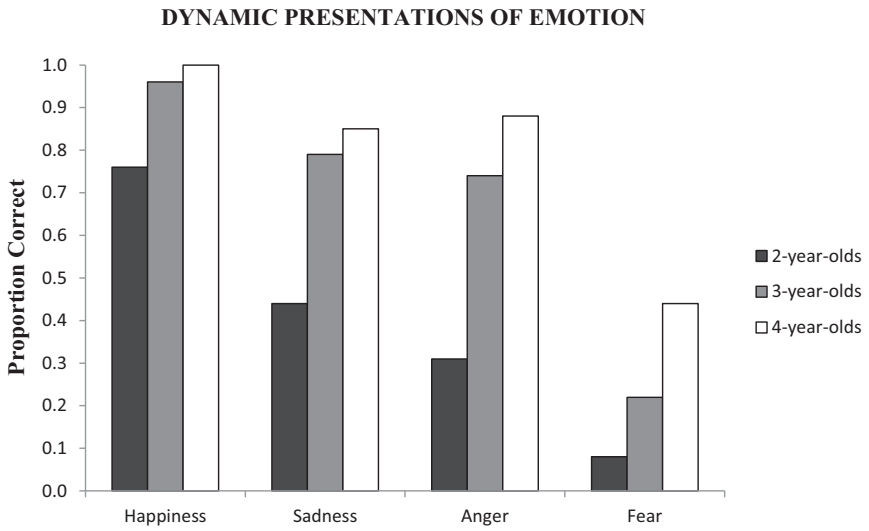

Fig. 2. Proportion of children using the correct discrete label for each emotion, presented by age group, Study 2.

An age by emotion interaction, $F(6, 207) = 3.17$, $p = .03$, was due to variations in improvement for different emotions (Fig. 2). Three- and 4-year-olds' correct labeling performance was similar when labeling happy, sad and angry stimuli (all p's $< .27$). When labeling fear stimuli, however, 3-year-olds' performance was lower than that of 4-year-olds and was similar to that of 2-year-olds ($p = .27$). Again, in a secondary analysis that included both child and adult data, the age by emotion interaction remained, $F(9, 279) = 7.48$, $p < .001$, indicating that children's labeling of fear was disproportionately lower than that of adults ($p = .003$).

A main effect of mode of presentation, $F(2, 138) = 6.35$, $p = .002$ (Table 1) showed that children were more likely to attribute the target emotion to the audiovisual clips and the Study-created photographs than the Standard photographs ($p = .001$, $p = .008$, respectively). Correct labeling of the Study-created photographs and the audiovisual clips were not significantly different ($p = .48$), and observed power for mode of presentation was sufficiently high (.895), ruling out a type II error.

3.2.3. Valence correct scores

When children's responses were coded in terms of valence, in contrast with Study 1, a 3 (age) $\times$ 3 (mode of presentation) $\times$ 4 (emotion) ANOVA found a main effect of mode, $F(2, 138) = 23.62$, $p < .001$, which indicated that children were most likely to provide a label of correct valence when labeling the audiovisual clips than when labeling either the Study-created ($p < .001$) or Standard photographs ($p = .01$) (Table 1). Children's labeling of the Study-created photographs was also higher than the Standard photographs ($p < .001$).

3.2.4. Any emotion vs. non-emotion scores

Again in contrast with Study 1, a 3 (mode) $\times$ 4 (emotion) $\times$ 3 (age) repeated-measures ANOVA showed that children's likelihood of attributing an emotion to the actor varied with the mode of presentation, $F(2, 138) = 15.61$, $p < .001$. Children were significantly more likely to attribute an emotion to the actor when presented with the dynamic audiovisual clips than when presented with either the Standard photographs ($p < .001$) or the Study-created photographs ($p = .007$) (Table 2).

3.3. Conclusion

Contrary to our expectations, the addition of body posture and vocal intonation to the dynamic audiovisual clips did not provide children an advantage over the static Study-created photographs

Table 2
Proportion of children selecting the correct label for each emotion by mode of presentation.

Emotion	Mode of presentation			
	Static photographs		Dynamic audiovisual clips	Mean
	Study-created	Standard		
Happiness				
Study 1	$.96_a$	$.96_a$	$.92_a$	.94
Study 2	$.90_a$	$.88_a$	$.94_a$	.91
Sadness				
Study 1	$.75_a$	$.58_b$	$.71_a$	.68
Study 2	$.72_a$	$.57_b$	$.79_a$	.69
Anger				
Study 1	$.73_a$	$.52_b$	$.54_b$	.60
Study 2	$.64_a$	$.61_a$	$.67_a$	.64
Fear				
Study 1	$.31_a$	$.29_a$	$.23_a$	.28
Study 2	$.29_a$	$.24_a$	$.22_a$	.25
Mean				
Study 1	$.69_a$	$.59_b$	$.60_b$	.63
Study 2	$.64_a$	$.57_b$	$.66_a$	.62

Note. Maximum = 1.00. Means in the same row that do not share a subscript differ significantly, $p < .001$ by least significant difference (LSD) comparisons (alpha = .05).

in providing the correct emotion label. However, the audiovisual clips did provide children some advantages over both sets of static photographs: children were more likely to label the stimuli with a label of the correct valence and more likely to label the audiovisual clips as portraying an emotion. Ultimately, these results do not support the supposition that children'sdiscrete emotion labeling errors stem from impoverished stimuli, but do suggest that the richer displays were beneficial to children in understanding other aspects of the display.

4. General discussion

4.1. Dynamic vs. static presentation

Several researchers have worried that static photographs do not fully convey the information present in a dynamic emotional expression. We therefore anticipated that audiovisual clips would provide children an advantage over static photographs in labeling the specific emotion conveyed. Our findings do not support this hypothesis. The likelihood of a child generating the correct discrete emotion label was not significantly higher with the audiovisual clips than with static photographs in either study. Static stimuli do not significantly underestimate children's discrete emotion knowledge.

In Study 2, the clips provided postural and vocal information. This additional information did result in an improvement in valence scores and in producing an emotion label. Nevertheless, these improvements still did not improve the child's chances of providing the correct discrete category label.

One especially surprising finding was that in Study 1, children were less likely to provide the correct discrete emotion label to the dynamic facial expressions than to the same facial expressions in static form (i.e. the Study-created photographs). Previous research suggests that adults analyze faces using a holistic process whereas children tend to use a featural one (Freire & Lee, 2001; Mondloch, Leis, & Maurer, 2006). It is possible that children attended to the moving features of the face rather than taking in the whole of the expression, thereby decreasing their performance as compared to the static expression. This possibility, and others, will have to be considered in future studies.

Children's performance labeling the facial expression clips in Study 1 (mean = .60) was lower than the clips with face, posture and voice in Study 2 (.66) (Fig. 3). Comparisons across studies are hazardous, but it is certainly possible that the additional information presented in the richer audiovisual clips provided children an advantage over the facial expression audiovisual clips. Although the difference

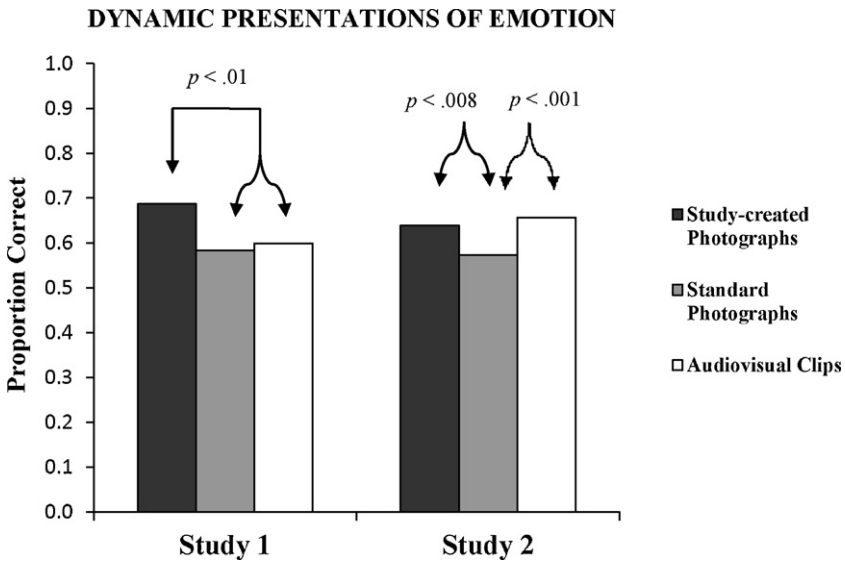

Fig. 3. Proportion of children using the correct discrete label by mode for Studies 1 and 2.

was small, this finding may explain why children's performance labeling the richer audiovisual clips was equal to the Study-created photographs, rather than lower (as was found in Study 1).

The adult comparison groups for each of these studies showed lower agreement when labeling the fear stimuli than when labeling the other emotions presented. This finding could have left the variation found with children's labeling of emotion in doubt. However, for each study, an analysis of adults' and children's performance labeling the stimuli showed that the emotion by age interaction remained, with adults' labeling of fear significantly higher than children's. These analyses indicate that, in both studies, children's performance was disproportionately lower when labeling the fear stimuli.

One concern in this study is the variation in intensity of the emotion stimuli presented. In both studies, however, the Study-created photographs and the audiovisual clips were rated as equally intense. In contrast, the Study-created photographs were rated as more intense than the Standard photographs and it is possible that the differences we found in children's labeling of these two sets of static photos were due to the intensity of the expressions presented. The improvement associated with intensity for these sets is an interesting finding worth pursuing.

This study relied on a free-label response format, due to concerns about inflated participant agreement with forced-choice formats (Russell, 1993). With the free labeling procedure, the agreement observed among participants is additionally convincing: it has not been artificially inflated by restricting participants' responses. However, when children do not generate the target label in response to a facial expression, it does not necessarily indicate their inability to recognize the discrete expression. It is possible that some nonverbal measure would reveal greater agreement for specific emotions than seen in this study. This question awaits future research.

4.2. A differentiation approach to categorization of facial expressions

The present results were consistent with Widen and Russell's (2003) claim that "errors" reveal rather than conceal children's understanding of the emotional meaning of facial expressions. These data can be used to explore that account further, because it has not previously been tested with dynamic stimuli. Their Differentiation Model predicts that children first acquire the label *happy*, followed by either the label *sad* or *angry*, using valence to categorize all emotions. Children then produce all three labels. Next, children go on to add either *scared* or *surprised*, further differentiating among emotions of negative valence. After acquiring both *scared* and *surprised*, children finally add *disgust*, to

complete the acquisition of the basic emotion labels, although children continue to broadly categorize these discrete emotional terms in non-adult ways, even after they are able to spontaneously produce the labels.

Data from both studies were re-scored as to whether each child fit one of the patterns predicted by the Differentiation Model or not.[1] All emotion labels children generate are included in the analysis, regardless of whether or not they were applied correctly. In Study 1, when children were presented with the dynamic facial expressions, 81% ascribed emotion labels as predicted by the Differentiation Model, a proportion consistent with previous research (Widen & Russell, 2003, 2008). Labeling of the Standard (83%) and Study-created (81%) photographs was similar. In Study 2, when children were presented with the richer dynamic presentations, 93% ascribed emotion labels as predicted, and labeling of the Standard (90%) and Study-created (94%) photographs was again similar. Dependent sample *t*-tests showed that there were no significant differences in Differentiation Model adherence between the modes of presentation for either study (Study 1: all p's > .32; Study 2: all p's > .48).

This support for the Differentiation Model, coupled with evidence that children's correct discrete labeling is not underestimated by static presentations, suggests that prior findings in which children do not recognize discrete facial expressions were not flawed. The more parsimonious explanation is that the research accurately reflects children's understanding. With this in mind, we suggest an alternative view of children's emotion labeling: children initially interpret faces and emotion labels in terms of valence, and use the few discrete labels they have acquired to convey this interpretation. Then, they gradually differentiate within these broad categories, eventually aligning more with adult-like interpretations of discrete categories. It is this interpretation, we believe, that provides researchers their best insight into children's conceptions of emotion.

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[1] Data on children's errors in both studies and on the labeling patterns predicted by the Differentiation Model analysis are available from the authors upon request.

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