REPORT

Preferences for colours and colour–emotion combinations in early childhood

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Abstract

Previous research has shown that, by the age of 3 to 4 years, children rely not only on perceptual similarity but also on shared category or other underlying structures to draw analogies. The present study extends this work by showing that children as young as 3 years old detect consistent relationships between colours and facial expressions of emotions – two phenomena that share no physical characteristics, violate conventional categories and have no obvious environmental contiguity. Two explanatory hypotheses are put forward: (a) learning by convention, which is explored against the standard of adults’ and older children’s matching patterns, and (b) reliance upon a common underlying but perceptually unavailable dimension – operationalized in terms of emotion and colour preferences in the context of the present study. Both explanatory approaches are discussed and avenues for future work are suggested.

While the basic purpose of human colour vision is to discriminate objects, at a more elaborate level this sensory capacity is used to attribute salience and meaning to chromatic stimuli. A prime example is that individuals not only show specific colour preferences but also attribute emotional characteristics to colours in consistent ways from school age on (e.g. Guilford & Smith, 1959; Karp & Karp, 1988; Whitfield & Wiltshire, 1990; Boyatzis & Varghese, 1994; Valdez & Mehrabian, 1994; Meerum Terwogt & Hoeksma, 1995). However, with the exception of studies on colour discrimination in infancy (Bornstein, 1975; Werner & Wooten, 1979; Adams, 1987), surprisingly little is known about the early development of perceptual attractiveness and emotional connotations of colours. The present research extends previous work back into early childhood. Such an extension raises important issues of both theoretical and practical interest.

The most important question to be addressed here is whether young children can detect a relationship between a colour and an emotional expression – two phenomena that share no physical characteristics, violate conventional categories, and have no obvious environmental contiguity. Different research traditions in cognitive development have provided evidence suggesting that the prerequisites for the construction of these relationships may already exist at an early age. First, research on conceptual development in young children has shown that by the age of 3–4 years children rely not only on perceptual similarity but also on shared category or other underlying structures to draw analogies (e.g. Brown, 1989; Markman, 1989; Goswami, 1992). This capacity to go beyond the mere appearance of the objects, relating them on some deeper grounds, might be a conceptual prerequisite to appreciating more abstract relationships, such as relating ‘bright’ to ‘happy’.

Further evidence comes from research on metaphor comprehension in young children. One could consider analogies such as ‘anger is like red’ and ‘sadness is like blue’ to be metaphors since they concur with the defining feature of a metaphor as a ‘similarity between objects and events that violate children’s conventional categories’ (Vosniadou, 1987, p. 873). Although it is generally acknowledged that preschool children have some ability to comprehend metaphors (Gardner & Winner, 1986; Vosniadou, 1987), it has also been found that this ability is fragile, especially in relation to metaphors describing psychological phenomena such as emotions (Winner, Rosenstiel & Gardner, 1976). More recent work, on the other hand, has suggested that even preschool children do have some basic intuitive...

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Finally, it has also been shown that preschool children are quite proficient in mapping emotions onto inanimate stimuli such as museum art (Callaghan, 1997) or music (see Zentner, 1999, for a review) in strikingly consistent ways. For years, the analogies children draw between psychological characteristics and inanimate stimuli were recognized (e.g. Werner & Kaplan, 1967) but often interpreted as accidental errors of categorization or as a result of imagination or animistic thinking characteristics of the preoperational child (Piaget, 1962; Chukovsky, 1968). However, although animism and magical thinking might facilitate the extraction of emotional information from inanimate stimuli, these concepts do not explain the consistency of the results.

While a systematic explanation of this phenomenon is beyond the aims of this report, the study of how children map colours onto emotions may provide a valuable research strategy to identify what children attend to when relating emotions to perceptual stimuli. One possibility, raised by a number of authors, is that from early childhood individuals organize their perceptual input around some basic dimensions, such as suggested by Osgood, Suci and Tannenbaum (1957). More specifically, the perception of an event would include processing both on a modality-specific dimension (such as having a particular colour or a particular emotion) and on a more basic amodal dimension (such as being more or less pleasant or intense). In this view, some translation of modality-specific input into an amodal code is taking place and this, in turn, provides the key for understanding why analogies between perceptually and/or categorically dissimilar phenomena can sometimes be drawn with a striking degree of consistency – even by very young children (e.g. Gardner, 1974; Gardner & Winner, 1986; Marks, Hammeul & Bornstein, 1987; Smith & Sera, 1992; Collier, 1996).

Colours are an interesting variable for the investigation of this hypothesis because they can be described using a series of abstract dimensions that are similar to the basic dimensions used to describe emotions (Osgood et al., 1957; Russell, 1980). Concurrent with this explanatory framework, Meerum Terwogt and Hoeksma (1995) recently suggested and found partial support for the hypothesis that colours and emotions may be related to each another due to the preference (valence) given to each of them within their own domain. Thus, in order to further examine the role of valence as a possible mediator between colours and emotions in young children, colour preference ratings were added to our design.

Another possibility is that even young children draw on cultural conventions when mapping colours onto emotions. This, in turn, would presuppose continguities of emotions and colours in the environment of the young child. Because adults largely provide this environment, comparing patterns in early childhood with the patterns manifested by adults could shed light on the role of learning. Consequently, an adult sample was also included for the purpose of comparison.

Beyond these theoretical issues, there is also an applied interest to young children’s affective responses to colours. For example, prevailing gender stereotypes such as ‘pink is for girls, blue is for boys’ are frequently used by advertisers and parents (e.g. Picariello, Greenberg & Pillemer, 1990). In addition, clinicians claim to possess knowledge concerning the emotional significance of colours for young children but little is known about how young children themselves feel about colour. Finally, experimental work with toddlers and preschoolers regularly involves coloured stimuli (e.g. toys, animals) without asking what impact different colours might have on young children’s attention and behaviour.

In summary the aims of this study were threefold: first, and most importantly, to investigate whether 3- to 4-year-old children show reliable colour preferences and map colours onto emotions in non-random ways; second, to compare how these early patterns are related to the results found with adults and older children; finally, to explore the role of colour and emotion valence (preference) as a possible mediator between the two phenomena. In designing this research, two methodological issues were of particular concern. First, colours can be defined in terms of hue, brightness and saturation. However, many studies in the psychology of colour have failed to provide adequate specification of colour samples yielding results that are difficult to interpret (see Valdez & Mehrbain, 1994, for a critique). The present colour samples were therefore specified in terms of a standardized system of notation (Munsell). Second, a procedure had to be devised that would not overtax the verbal and attentional capacities of 3-year-old children. Accordingly, subjects’ colour preference ratings were obtained by asking them to choose their preferred one from an array of nine coloured cardboard rectangles. In the colour–emotion mapping task, children were instructed to match six coloured cardboard rectangles to three cartoon-like drawings of faces designed to express emotions of happiness, sadness and anger.

**Method**

**Participants**

127 children, predominantly of Caucasian middle-class parents, were recruited from daycare centers and pre-
schools in a major Swiss urban area. Of these 127 children, 106 (50 males, 56 females) successfully completed the colour preference task, and 103 (53 males, 50 females) showed successful performance on the colour–emotion matching task (see below for details). The mean age was 45 months (age range 30–58 months).

In addition, we included a sample of 65 undergraduates (31 males, 34 females). The mean age was 23.4 years (age range 18–39 years). The participants were primarily Caucasian and middle class.

Materials

Materials used in the colour preference task consisted of nine 35 cm × 50 cm cardboard rectangles coloured in red, yellow, dark blue, bright blue, dark green, bright green, pink, brown and black. We chose fully saturated colours that varied on hue and value (see Table 1 for the precise colour notation).

Practice matching task

The materials for the practice matching task consisted of four stimuli (standards) which were designed to correspond to a second set of four stimuli (targets). The four target pictures were a bird, a shoe, a baby and a Santa Claus, each painted on a 33 cm × 50 cm cardboard rectangle. The standard pictures consisted of a tree, a sock, a milk bottle and a gift, presented on 16 cm × 16 cm cardboard rectangles (see Figure 1).

Colour–emotion matching task

In analogy to the practice task, the materials for the colour–emotion matching task consisted of six colour stimuli (standards) and three targets displaying three schematic faces, expressive of happiness, sadness and anger, which were painted on 33 cm × 50 cm cardboard rectangles (see Figure 2). These emotions were chosen because they are basic as defined by Ekman and Friesen (1975) and because they are easily understood even by very young children (e.g. Stein & Levine, 1987; Harris, 1989). The six standards to be matched with these target pictures were 16 cm × 16 cm cardboard rectangles, coloured in red, yellow, bright green, dark blue, brown and black (see Table 1). Considering our young age group, the number of colours was reduced from nine to six for this task, yielding a 3 (emotion) × 6 (colours) array.

Mother questionnaire

To obtain demographic information and the mother’s perception of their child’s preferred colour, a questionnaire was given to each mother. The relevant question asked: ‘Does your child have a preferred colour? If yes, which one?’

Procedure

Colour seriation task

Children were tested individually in a quiet room in their daycare center under daylight conditions. Before the child entered the room, the nine colours were laid out in a half-circle, about 1 m away from the child, with the position of colours in the half-circle randomized across subjects. The experimental session began by drawing the child’s attention to the nine colours and by asking the
child to pick the colour he/she liked most and to bring it back to the experimenter. The same procedure was then repeated for the eight remaining colours until the last, and least preferred one, was left. Thus, each time the child returned the colour to the experimenter, a preference rank for that colour was recorded by an assistant of the experimenter who was unobtrusively seated in a corner of the testing room. Children who picked the colours in the preset order were not included in the analyses (N = 21).

Practice matching task

After completion of the colour seriation task, the child was introduced to a practice matching task. The child was shown the four target pictures and the corresponding standards and told that it was his/her task to find out which one would go with which (see Figure 1). Boxes were placed under each of the four targets, such that the items to be matched with the targets could be placed by the child into the corresponding box. A response was recorded whenever the child put a standard into the box of one of the target alternatives. Successful performance on this practice task was expected to be a prerequisite for understanding the colour–emotion matching task. Therefore, children who matched less than three out of four items correctly were not tested on the subsequent task.1

Colour–emotion matching task

After a short break, the children were shown the three faces displaying a happy, a sad and an angry expression and were asked to identify the expression of the ‘fellows’ (‘bonhommes’) in the pictures. Out of the 127 children, only six (4.7%) needed help with identifying the expressions. These children were prompted with questions such as ‘Does one of them seem happy? Show me which one’. The children were then shown the six colour stimuli which were positioned approximately 50 cm in front of the child with order of presentation randomized across subjects. Then, the child was asked to choose a colour for each of the three ‘fellows’, a colour that ‘would go well with’ the character in question, and to put the colour into the box of the specific ‘fellow’.2

1The following routes could lead to three correct answers: (1) the match of the sock with Santa Claus was counted as correct; (2) some children put more than one item in the same box; (3) some children stopped after three correct mappings.

2After the colour was put in a box it was not available for future selections. A small number of children put a second colour into the same box. In these cases the first choice was counted.

Adults

Adults were tested in a group session. The same nine coloured cardboards used for the children were mounted on a wall. On a response sheet, subjects were asked to indicate their order of preference and to then match the colours red, yellow, green, blue, brown and black with the emotions of happiness, sadness and anger. To control for response bias, order of presentation of colours and of emotions was inverted for half of the subjects.

Results

Colour preferences

Agreement with mothers

Maternal reports of their child’s preferred colour agreed with the child’s first or second choice 71% of the time (κ = 0.67), providing evidence for the validity of our measurement.

Colour ranking

Mean ranks of each colour are given in Table 2. The existence of overall colour preferences was revealed by a highly significant Friedman analysis of variance, χ²(8, N = 106) = 65.48, p < 0.001. The result was significant for both males (χ²(8, N = 57) = 18.53, p = 0.018) and females (χ²(8, N = 49) = 56.60, p < 0.001). As determined by a multivariate repeated measures analysis of variance (MANOVA) with sex as the between-subjects factor and colour as the repeated measure, there was no sex × colour preference interaction, F(8, 97) = 1.54.

Table 2

<table>
<thead>
<tr>
<th>Colour</th>
<th>Mean rank</th>
<th>(SD)</th>
<th>Adults Mean rank</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>3.73</td>
<td>(2.33)</td>
<td>Dark blue</td>
<td>2.89* (2.08)</td>
</tr>
<tr>
<td>Pink</td>
<td>4.23**</td>
<td>(2.68)</td>
<td>Bright blue</td>
<td>3.71** (2.36)</td>
</tr>
<tr>
<td>Dark blue</td>
<td>4.53**</td>
<td>(2.57)</td>
<td>Red</td>
<td>3.88 (1.87)</td>
</tr>
<tr>
<td>Yellow</td>
<td>4.82</td>
<td>(2.45)</td>
<td>Dark green</td>
<td>4.74 (2.48)</td>
</tr>
<tr>
<td>Bright green</td>
<td>5.00†</td>
<td>(2.52)</td>
<td>Yellow</td>
<td>5.28 (2.38)</td>
</tr>
<tr>
<td>Bright blue</td>
<td>5.24**</td>
<td>(2.61)</td>
<td>Black</td>
<td>5.54 (2.62)</td>
</tr>
<tr>
<td>Dark green</td>
<td>5.36</td>
<td>(2.40)</td>
<td>Bright green</td>
<td>5.72† (2.53)</td>
</tr>
<tr>
<td>Brown</td>
<td>5.95†</td>
<td>(2.46)</td>
<td>Pink</td>
<td>6.46† (1.34)</td>
</tr>
<tr>
<td>Black</td>
<td>6.02</td>
<td>(2.40)</td>
<td>Brown</td>
<td>6.65† (1.83)</td>
</tr>
</tbody>
</table>

Notes: Colours in bold held significantly different orders of preference in the two samples. * * Reliable between-group differences (df = 169), p < 0.001. † Marginally significant between-group differences, p < 0.10.
\( p = 0.154 \) (Wilk’s \( \lambda = 0.89 \)). Although this indicates that boys and girls did not differ significantly in their colour preferences, there was a marginal difference in the strength of the patterns, with girls being slightly more sensitive (\( z = 1.35, p = 0.088 \)).

This was particularly clear in examining girls’ and boys’ reactions to brightness. This was done by creating an overall dark versus bright preference score which was obtained by adding, for each child, the ranks for dark (dark blue, brown, dark green, black) and bright (pink, red, bright green, bright blue, yellow) colours. If the overall dark score was lower than the overall bright score, a dark preference was noted, and vice versa (since lower ranks denote greater preference). The majority of children (68.1%) manifested a bright preference, but this was relatively more true for girls (77.8%) than for boys (59.2%), \( \chi^2(1, N = 106) = 3.73, p = 0.053 \).

Comparison with adults

Overall differences in colour preference between children and adults were analysed using a MANOVA with age as the between-subjects factor and colour as the repeated measure. This analysis showed a highly significant age × colour preference interaction, \( F(8, 162) = 8.62, p < 0.001 \) (Wilk’s \( \lambda = 0.70 \)), indicating that the profile of colour preferences differs reliably between 3-year-old children and adults. The descriptive statistics listing the mean ranks for each colour in children and adults is shown in Table 2.

Colour–emotion association

Practice matching task

65.4% of the children in our sample matched all four items correctly, and 80.4% met our criterion of matching three out of four items correctly. Accordingly, the remaining 19.6% (\( N = 25 \)) of the children were not tested on the colour–emotion matching task.

Colour–emotion matching task

The descriptive statistics for the colour–emotion association are given in Table 3. \( \chi^2 \) computed across these values was significant at \( (10, N = 103) = 17.66, p = 0.061 \). This value, however, has to be treated with caution given that the assumption of independence of observations is not met. Moreover, as an ‘omnibus test’ it is not very informative. Thus, more focused analyses in which the assumption of independence was met were carried out.

| Table 3: Patterns of colour–emotion mappings in children |
|-----------------|-----|-----|-----|-----|-----|-----|
|                 | Red | Yellow | Blue | Brown | Green | Black |
| **Happiness**   |     |       |     |       |       |       |
| Males           | 21  | 11    | 8   | 3    | 6    | 4    |
| Females         | 9   | 13    | 8   | 6    | 6    | 8    |
| **Total**       | 30  | 24    | 16  | 9    | 12   | 12   |
| **Sadness**     |     |       |     |       |       |       |
| Males           | 9   | 3     | 16  | 12   | 8    | 5    |
| Females         | 10  | 6     | 14  | 5    | 4    | 11   |
| **Total**       | 19  | 9     | 30  | 17   | 12   | 16   |
| **Anger**       |     |       |     |       |       |       |
| Males           | 8   | 12    | 10  | 9    | 8    | 6    |
| Females         | 11  | 7     | 13  | 5    | 5    | 9    |
| **Total**       | 19  | 19    | 23  | 14   | 13   | 15   |

Happy/sad

First, one could expect that children tend to match bright colours with a happy emotional expression and dark colours with a sad emotional expression. This prediction was confirmed by comparing the number of children choosing a bright colour (yellow, red, green) for the happy expression and a dark colour (blue, brown or black) for the sad expression with the number of children choosing the opposite pattern, namely a dark colour for the happy and a bright colour for the sad expression: 48/21, \( p < 0.001 \), by the binomial theorem. Similarly, the number of children choosing either red or yellow for the happy expression and either blue or brown for the sad expression was three times the number of children choosing the opposite pattern: 30/10, \( p < 0.001 \).

Sex differences

Whereas blue and yellow had similar emotional connotations for boys and girls, the associations for red and brown were gender-specific. Boys matched red more than twice as often with the happy than with the sad face (21/9, \( p = 0.021 \)), whereas girls did not do so (9/10, ns). Similarly, boys matched brown four times as often with the sad than with the happy face (12/3, \( p = 0.018 \)), whereas girls’ matching patterns for the colour brown were random (5/6, ns). The colours green and black had no particular emotional connotation for either girls or boys.

Age differences

Due to the relatively wide age range in our sample, we were able to split the sample into a younger age group (mean age 3.3 years, \( N = 53 \)) and an older age group.
(mean age 4.1 years, \( N = 50 \)). The ratio of ‘predicted’
(bright–happy/dark–sad) to ‘unpredicted’ (bright–
sad/dark–happy) matches was above chance in both
age groups (younger 24/12, \( p = 0.03 \); older 24/9,
\( p = 0.007 \)), suggesting no substantial difference in the
ability to detect similarity between colour and emotion
between 3 and 4 years of age.

**Anger**

Overall, the results for anger were weak and non-
significant. Only yellow was matched significantly more
with the angry than with the sad facial expression,
12/3, \( p = 0.018 \).

**Comparison with adults**

Adults’ colour–emotion matches are in several ways
different from 3-year-olds’ associations (see Table 4).
For example, red is rarely matched with happiness and
becomes the colour of anger. In addition, sadness is
primarily associated with black (rather than blue).
Similar in both samples was the choice of yellow for
happiness and the non-emotionality of the colour green.

**Relation of colour preference to emotion preference**

Although emotion preferences were not measured
directly in this study, the literature on emotion
preference in preschoolers suggests that happiness is
preferred over both sadness and anger (Russell &
Bullock, 1985). Thus, the respective emotions were
dummy coded as 0, 1, 1 (lower values denoting higher
preference). For each subject, the three emotions coded
as such were then paired with the rank of the specific
colour the three emotions had been associated with. The
resulting point biserial correlation was \( r_{pb} = -0.001, \)
\( p = 0.97, \) ns, indicating no relation between colour and
emotion preference.

**Discussion**

In general, our results suggest that chromatic stimuli
carry different degrees of perceptual attractiveness
and different emotional meanings for 3- to 4-year-old
children. We can therefore anticipate that even very
young children have the capacity to detect relationships
between the perceptually unrelated phenomena of
colours and emotions. This result adds to the literature
in several ways. First, and compared to related studies,
this study included an unusually young age group, an
unusually large sample size, and colour sample specifica-
tions in terms of a standardized system. Second, the
data extended research that has shown that, by the age
of 4 years, children can make sense of metaphors
involving emotions and can map emotions onto paint-
ings and music (see introduction). Finally, the method
devised underscores the feasibility of empirical work on
affective responses to perceptual stimuli even with very
young children. The following discussion will highlight
the most important findings from both tasks, compare
them to the results from previous studies, and discuss
some avenues for future research.

**Colour preferences**

Red was the preferred colour for both girls and boys.
This result is consistent with infant colour preferences
(Bornstein, 1975; Adams, 1987) but contradicts the well-
established preference for blue in adults (see Eysenck,
1941; Valdez & Mehrabian, 1994), a preference that was
replicated with our own adult sample. Two recent
studies suggested that a preference for blue over red
might already be established by 7 years of age (Boyatzis
& Varghese, 1994; Meerum Terwogt & Hoeksma, 1995).
Thus, an important developmental transition in the
perceptual attractiveness of colours seems to occur
during the preschool and early elementary school years.
The developmental decrease in preference for red might
be due to the fact that red is a more ambivalent colour
than blue across cultures (Adams & Osgood, 1973),
representing such unpleasant things as blood, danger or
corrections (see Safuanova & Safuanov, 1992). Appar-
etly, these connotations are not present in early
childhood but are gradually acquired through increased
social contact and schooling.

No evidence was found for widespread gender
stereotypes such as ‘pink is for girls and blue is for
boys’ (see Picariello et al., 1990; Pomerleau, Bolduc,
Malcuit & Cosette, 1990). However, although both genders preferred bright to dark colours, the overall brightness preference was relatively stronger for girls than boys. This finding is consistent with previous research which suggested general similarities in male and female preferences for various colours, while noting slight sex differences in the strengths and consistencies of those preferences (Norman & Scott, 1952; Whitfield & Wiltshire, 1990; Boyatzis & Varghese, 1994; Valdez & Mehrabian, 1994; Hemphill, 1996). Our findings suggest that this gender bias towards greater chromatic sensitivity in females is already present in early childhood.

The data on colour preferences in young children is potentially relevant to an old issue – the relation between the linguistic evolution of colour terms and the organization of colour perception in early childhood. In their well-known study concerning the universal acquisition of colour terms, Berlin and Kay (1969) argued that colour terms evolved in the following fixed order (achromatic colours omitted): (1) red, (2) green–yellow, (3) blue, (4) brown, (5) pink–orange–purple. If the perceptual attractiveness of colours played a role in learning, e.g. by making certain colours more salient or memorable, then the same perceptual attractiveness might have influenced the linguistic evolution of colour terms. If this was true we should expect a correspondence between the evolutionary order of colour terms and early emerging colour preferences. In line with past research (see Bornstein, 1985, for a review), however, the present results were inconclusive in this regard.³

**Colour–emotion mappings**

The association of happy with bright colours and sad with dark colours is established by 3 years of age. More specifically, whereas yellow was most often matched with the happy and, to a minor extent, angry facial expressions, blue was most consistently associated with the sad facial expression. Furthermore, red and brown had emotional connotations for boys, but not for girls. The results for green and black were inconclusive.

In comparing these findings with the results of the adult sample and with data from previous research, the similarities are stronger for yellow, dark blue and brown than for red and black. For example, the current finding that yellow was mapped onto the happy and angry facial expressions is consistent with the finding that, for adults, the hue spectrum of green-yellow is associated with emotional responses of arousal and dominance (Valdez & Mehrabian, 1994). Furthermore, the link of yellow with happiness has been repeatedly found in work with adults (e.g. Wexner, 1954; Collier, 1996) and with children (e.g. Lawler & Lawler, 1965; Karp & Karp, 1988). The link of blue with sadness is so pervasive that it has entered the English language and numerous studies with both adults and children report blue to be matched with sadness (e.g. Karp & Karp, 1988; Collier, 1996). The sadness connotation of blue might be related to the fact that the hue spectrum of purple-blue (similar to the dark blue used in the present study, see Table 1) is perceived as low in arousal (Valdez & Mehrabian, 1994).⁴

In contrast to the developmental consistencies in the emotional connotations of blue and yellow, differences emerge for black and red. There is evidence that by 10 years of age children categorize black as sad and red as angry (Karp & Karp, 1988) – connotations that appear to be absent in early childhood. The developmental shift for black and red lends further support to the argument that certain meanings of colours, perhaps particularly negative ones, are gradually acquired throughout the preschool and elementary school years. Some degree of caution, however, is needed in interpreting these comparative results. First, past research often provided insufficient stimulus descriptions (e.g. such as ‘blue’ and ‘green’) and so only approximative comparisons are possible. Second, the present stimulus set was limited. Future research would need to clarify to what extent the present findings are resistant to slight variations in hue and brightness.

Having demonstrated that young children can detect consistent relationships between colours and facial expressions of emotions, how children relate these two phenomena still needs to be explained. Clearly, children’s performance can be attributed neither to perceptual nor to categorical similarity. As anticipated in the introduction, there are at least two non-mutually exclusive explanations that can now be elaborated on the basis of the present findings. One possibility is that children draw on cultural conventions when projecting colours onto emotions. A certain difficulty with this explanation is that it presupposes a contiguity between colours and expressions of emotions in the environment of the very young ³As can be seen in Table 2, there is only partial correspondence between the two. However, as indicated by Rosch (1972) long ago, a poor or inconsistent match between the linguistic evolution of colour terms as described by Berlin and Kay and the early organization of colour perception can indicate different things – an independence of the two phenomena, limitations in the developmental work – but it could also reflect shortcomings of the classic anthropological work. At present, not enough is known to resolve this question.

⁴Interestingly, the present adult sample chose black rather than blue for sadness. In contrast to past studies, however, both blue and black were presented simultaneously. Given a choice of black and blue, adults from this particular cultural background might favour black.
child for which there is no direct evidence at present. Of
course, some indirect evidence comes from adults who
attribute emotions to colours in highly consistent ways.
However, if children simply adapted the preferential
and associative patterns from adults, then their patterns
should conform to those of adults. The partial lack of
resemblances found in this study undermines this
interpretation and suggests a role for alternative learning
mechanisms. Keeping the robust association of happy
with bright colours and sad with dark colours in mind, it
may be that young children develop this association due
to the way happy and sad characters are coloured in
children’s books, to colour–emotion metaphors nested in
everyday language or to personal experiences with light
and darkness (Williams, Boswell & Best, 1975). More
studies are needed to examine the potential impact of
these learning mechanisms.5

However strong the impact of learning, what remains
remarkable from a cognitive point of view is the ease
with which even 3-year-old children are able to over-
come the perceptual and conceptual gap between a
coloured cardboard rectangle and a facial expression of
an emotion. Although the relation between this ability
and other cognitive skills emerging at this age remains
to be explored, research has shown that an ability to
categorize objects relying on underlying structure
rather than on perceptual similarity develops rapidly
between 3 and 4 years of age (e.g. Goswami, 1992).
Interestingly, however, the underlying structure in the
present study is of a more abstract nature than in most
standard classification tasks. Thus, the possibility was
raised at the beginning that when children classify
certain colours with certain emotions they might refer
to a perceptually unavailable dimension or to an
‘amodal code’. Building upon Meerum Terwogt’s
study, and drawing upon the dimensional approach
within emotion research, we explored the role of
valence as one possible amodal dimension underlying
young children’s projections of colours onto emotions.
The fact that little support was found for this particular
assumption may not come as a surprise to emotion
theorists who have argued in favour of treating
preferences and emotions as separate entities (Scherer,
2000). In this view the former might simply reflect an
aesthetic judgement that has little to do with emotional
content.

However, valence is not the only dimension to
be investigated within this theoretical framework.

Colours offer two additional possibilities: saturation
(chroma) and brightness (value). The link between
emotion and brightness, which this study demon-
strated, clearly encourages extension of research on
brightness. In addition, to the extent that variations in
saturation are perceived as variations in intensity or
strength, they would provide an obvious conceptual
bridge between a colour and an emotion. Thus,
systematically varying the colour components of
brightness and saturation while examining how these
variations map onto different emotional expressions is
an important future avenue for discovering what
young children attend to when overriding the category
boundaries of colours and emotions.

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5 Work on ‘metaphorical mapping’ in infants (see Wagner, Winner,
provides useful suggestions on how the reported phenomena might be
investigated with still younger children.

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