THE DEVELOPMENTAL ACQUISITION OF BASIC COLOUR TERMS

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1. Introduction

The difficulties young children experience in acquiring basic colour vocabulary have intrigued scientists for well over a hundred years. One of the earliest observations was reported by Charles Darwin (1877) who was struck by the relative ease with which his children acquired the names for everyday objects compared to the tardy and erratic nature by which they learnt colour terms, as the following extract illustrates:

> I carefully followed the mental development of my small children, and I was astonished to observe in two or, as I rather think, three of these children, soon after they had reached the age in which they knew the names of all the ordinary things, that they appeared to be entirely incapable of giving the right names to the colours of a colour etching. They could not name the colours, although I tried repeatedly to teach them the names of colours. I remember quite clearly to have stated that they are colour blind. But afterwards this turned out to be an ungrounded apprehension. (Translated from the German by, and cited in Bornstein 1985:74)

Based on the naturalistic observations and empirical studies of early investigators (e.g. Baldwin 1893; Nagel 1906; Binet & Simon 1916; Vernon 1962; Istomina 1963; Modreski & Goss 1969; Miller & Johnson-Laird 1976; Bartlett 1978; Cruse 1977), Bornstein (1985) identified six features that characterize colour term acquisition: (1) children can perceive (discriminate, match and categorize) colour from early infancy, well before they learn colour names; (2) children answer questions about colour with colour words prior to accurate colour term acquisition; (3) children acquire different colour terms before they have referential meaning; (4) colour terms are applied erroneously in a haphazard manner; (5) colour terms are acquired relatively late, at around four years of age; and (6) girls tend to acquire colour terms at an earlier age

than boys.

Another feature of colour term acquisition concerns the order in which children acquire colour vocabulary. Berlin and Kay (1969) proposed that colour terms are added to languages across the world in a fixed order, and this order was believed to be universal in nature as it was thought to arise from the neurophysiology of the human visual system. In their seminal study, Berlin and Kay identified a maximum of eleven basic colour categories that they proposed are mapped systematically to the corresponding colour terms of a given language, these being black, white, red, yellow, green, blue, brown, orange, purple, pink and grey. Miller and Johnson-Laird speculated as to whether "ontogeny recapitulates phylogeny", such that young children may be expected to acquire knowledge of the terms identified by Berlin and Kay as being universal by progression through seven stages, as illustrated in Figure 1a (Miller & Johnson-Laird 1976:354). However, a simplified version (Figure 1b) predicts children should acquire the terms referring to the first six categories (acquired in Stages 1-5) before the remaining five (acquired in stages 6-7), as the first six terms denote the 'primary' categories (black, white, red, yellow, green and blue) that are considered to be perceptually unitary or unique and cannot be described in terms of any other colour combination, whereas the remaining five terms denote the 'non-primary' categories that can be described by using a combination of the six primary terms. Even in the most recent reformulations of Berlin and Kay's original theory (e.g., Kay, Berlin & Merrifield 1991; Kay, Berlin, Maffi & Merrifield 1997), a temporal advantage for the acquisition of primary over non-primary colour terms is predicted.

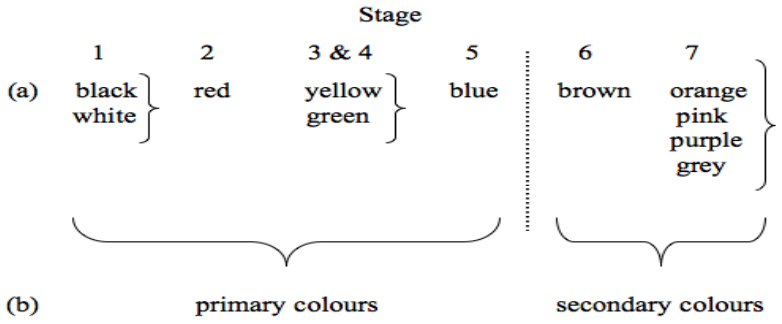

Figure 1: *Fixed developmental order of colour term acquisition proposed by Berlin and Kay (1969). (a) Original seven-stage order that is analogous to the evolutionary order thought to reflect colour term acquisition across languages. (b) Simplified version in which a temporal advantage for primary colours is predicted.*

In this paper we review evidence from our own studies and others that addresses three fundamental features of colour term acquisition. First, we investigate the tardy acquisition of colour terms. Second, we examine if there is a developmental order of colour term acquisition. And third, we consider different factors that may shape any differential acquisition process.[1]

2. *Are colour terms acquired late?*

One of the most striking features concerning the difficulties young children experience with learning colour terms is that, during the early stages of infancy, the ability to perceive colour develops well before the onset of colour term acquisition. By four months of age, psychophysical studies have shown that infants can distinguish between colours (e.g., Maurer & Adams 1987; Teller 1998; Teller & Bornstein 1985); sensitivity to colour contrasts develops alongside sensitivity to differences in luminance (Allen, Banks & Norcia 1993; Teller 1998); and basic colour categories are perceived (Bornstein, Kessen & Weiskopf 1976; Catherwood, Crassini & Freilberg 1989; Franklin & Davies 2004). Although refinements in chromatic discrimination continue throughout childhood into adolescence (Knoblauch, Vital-Durand & Barbur 2001), these studies show that, when a child starts to learn colour terms, they have been experiencing the world in colour since infancy and possess a categorical organization of colour percepts onto which linguistic labels can be mapped (see also Bornstein; Franklin & Davies; and Bonnardel & Pitchford, in this volume).

As such, the task of acquiring colour nomenclature requires the referential mapping of colour terms to colour percepts (Soja 1994; Braisby & Dockrell 1999), yet this appears to be particularly problematic for young children. An established literature suggests there is a lower age limit by which children develop accurate colour naming, which is surprisingly late, at around four years (e.g., Heider 1971; Mervis, Catlin & Rosch 1975; Johnson 1977; Bornstein 1985). Furthermore, children have been shown to require sometimes hundreds of presentations of a colour term paired with a colour sample before the appropriate term is learned (Rice 1980). The effortful and tardy nature by which children acquire colour terms contrasts sharply with the relative ease and speed by which they learn the names of everyday objects, which can occur within a

[1] All the children in these studies had English as a first language; some were British and some Canadian.

single occurrence of hearing a novel noun spoken in context (e.g. Carey 1978). As a consequence, colour terms have been regarded as having a special status in lexical development, requiring the implementation of a unique system of multiple mappings for successful acquisition (Sandhofer & Smith 1999).

We questioned, however, whether it is really appropriate to compare the lexical acquisition of colour terms to that of familiar objects, given that these two types of words differ greatly in functional significance (Pitchford & Mullen 2001). Unlike nouns that are used to label everyday objects, colour terms are adjectives and refer to a perceptual object property that can be used to distinguish between objects of similar shape. In contrast, nouns are used to distinguish objects that typically differ in shape. It has been suggested that children may initially conceptualize object shape, as it is relatively more informative about the function of an object than is colour (Au & Markman 1987; Macario 1991; Soja 1994). Knowing the colour of an object may provide no information as to its function. For example, different-coloured objects may share the same function (for example, a dress may be red, black, orange, or any other colour), and similarly-coloured objects may have different functions (for example, a yellow object may be a daffodil, canary, banana and so on). Consequently, during the early stages of vocabulary acquisition, children may expect novel linguistic labels to refer to an object's shape rather than its colour (Baldwin 1989), and this may impair the lexical acquisition of colour terms relative to common nouns. Given the differences in the functional significance of colour compared to familiar objects, we argued that it might be more appropriate to compare the lexical acquisition of colour terms to that of other perceptual object attributes, such as size and motion, that, like colour, are used to make within-category distinctions. Very few studies have yet taken this approach (Sandhofer & Smith 1999).

To investigate whether colour terms are selectively delayed relative to other comparable visual attributes, we compared the ability of young children with language skills ranging from two to five years, to comprehend and name two colours (red and green), two sizes (big and small), two speeds (fast and slow side-to-side motion), and two shapes (T and O) that were functionally meaningless to preliterate children (Pitchford & Mullen 2001). The tasks were all computerized and stimuli are illustrated in Figure 2. The comprehension task required children to point to one of two simultaneously presented stimuli, each of which comprised one of the four visual attributes, and differed only in the attribute being tested (see Figure 2a). For example, when testing comprehension of colour, a stimulus pair comprising a big, red T moving slowly and a big,

green T moving slowly was presented and the child was asked "Which is green?" The naming task also presented pairs of stimuli differing only in the attribute to be named, and computer voice-over named each attribute twice as attention was drawn to the appropriate stimulus by means of a large arrow. The child was then shown only one of the stimuli and was asked "What's this one?" (see Figure 2b). We were surprised to find no difference in children's ability to

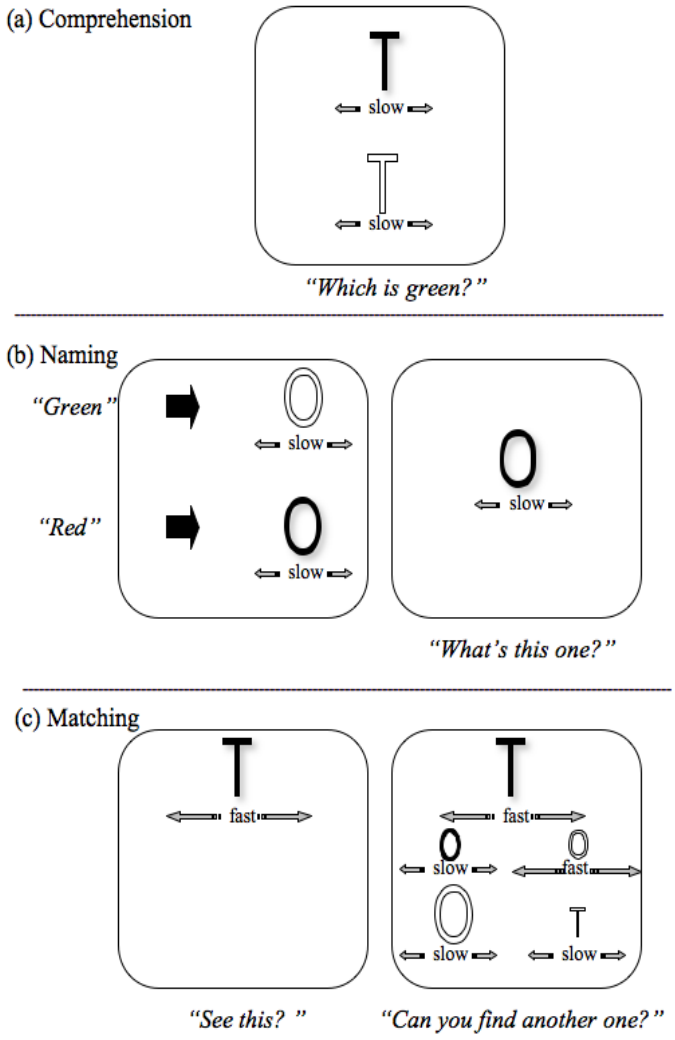

Figure 2: *Schematic illustration of experimental stimuli used in Pitchford and Mullen (2001) where filled-black indicates red stimuli and open-white indicates green stimuli.*

either comprehend or name colour compared to the other visual attributes, by children of any age (see Figure 3). This result is intriguing because it challenges the historical contention that colour terms are selectively delayed.

In an additional experiment, we assessed the relative perceptual saliency of these four attributes using a match-to-sample task that required children to match to a target stimulus with each of the four attributes (for example, a big, red T moving fast), to one of four alternative stimuli, each of which matched the target in only one attribute (for example, a stimulus matching the above target in colour would be a small, red O moving slowly) (see Figure 2c).

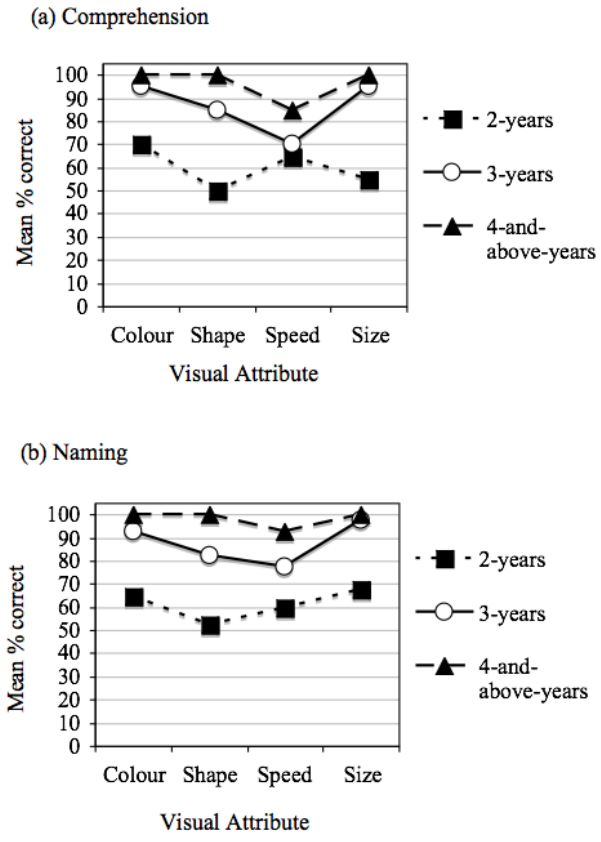

Figure 3: *Mean percentage of correct responses on the (a) comprehension and (b) naming test used in Pitchford and Mullen (2001). As comprehension was measured using a two-alternative-forced-choice task, there was a 50% chance of answering correctly by guessing.*

Children's responses on this task indicated their preference for matching objects on a particular visual attribute.

Results revealed that colour was a salient object property, particularly for children with a language-age of three years, as they made significantly more matches on the basis of colour (55%) than any other visual attribute (shape 26%, speed 9%, size 10%). By comparison, for children of four years and above, shape became the most salient attribute on which to make perceptual groupings, with these children making significantly more shape-based matches (90%) than matches based on colour (7%), speed (1%), or size (2%). The shift in perceptual saliency from colour to shape at this age is consistent with previous studies (e.g. Brian & Goodenough 1929; Kagan & Lemkin 1961; Suchman & Trabasso 1966; Miller 1977; Baldwin 1989), and has been regarded by some to reflect an awareness of object shape as more indicative of category membership than object colour (e.g. Baldwin 1989; Landau, Smith & Jones 1988). The predominant perceptual saliency of colour compared to other visual attributes at three years contrasts with the fact that there is no selective advantage in the ability to either comprehend or name colour compared to the other visual attributes by children at three years, or any other age (see Figure 3). This result is intriguing because it shows that differences in perceptual saliency do not appear to facilitate lexical acquisition.

Thus, in summary, when colour is compared to that of other visual attributes, using identical experimental procedures, we find no selective delay in the developmental acquisition of colour terms. We suggest that colour terms do not constitute a special class of words in lexical acquisition, but rather develop alongside the acquisition of other adjectives that describe the visual properties of objects.

3. Are basic colour terms acquired in a fixed developmental order?

As outlined above, Miller and Johnson-Laird (1976:354-355) proposed that children would acquire a vocabulary of the eleven basic colour terms in the same sequential order in which Berlin and Kay (1969) had claimed colour terms were added to the different languages of the world. This order, illustrated in Figure 1 in its simplest form, predicts that children will learn the six primary colour terms at an earlier developmental stage than the five non-primary colour terms. Support for this developmental order, however, has been mixed. For example, an advantage for naming primary over non-primary colour terms has been found in studies of English-speaking children (e.g. Heider 1971; Johnson

1977; Cruse 1977) and in cross-cultural studies of other languages (e.g. Davies, Corbett, McGurk & Jarrett 1994; Davies & Corbett 1998; Dougherty 1978; Istomina 1963). However, an advantage for primary over non-primary colour terms is typically not found when using non-production (for example, comprehension or matching) tasks to assess colour term knowledge (Heider 1971; Andrick & Tager-Flusberg 1986). Furthermore, several studies have failed to find any support for the earlier appearance of primary compared to non-primary colour terms in preschool children (e.g. Bartlett 1978; Mervis et al. 1975; Mervis, Bertrand & Pani 1995; Shatz, Behrend, Gelman & Ebeling 1996).

It is difficult to draw conclusions from such contradictory findings, and the matter is further complicated by methodological differences between studies. Most studies measure colour term knowledge using only one task (for example, comprehension or naming) and this varies across studies (e.g. Cruse 1977; Heider 1971; Johnson 1977). Colour term knowledge is typically measured in only one age group, which varies across studies (e.g. Heider 1971; Shatz et al. 1996). Many studies test knowledge of less than the full complement of eleven basic colours, which makes comparisons between primary and non-primary colours difficult (e.g. Andrick & Tager-Flusberg 1986; Davidoff & Mitchell 1993; Heider 1971; Johnson 1977; Shatz et al. 1996). In addition, all previous studies have taken mean number or percent correct as the dependent variable (e.g. Andrick & Tager-Flusberg 1986; Bartlett 1978; Heider 1971), which is likely to give a misleading impression of colour term knowledge, especially when there is a response bias. Typically, when a child has very few colour terms in their lexicon, they will tend to use one colour term repeatedly. For example, a child that has only acquired the term *blue* will answer 'blue' to all colour stimuli (e.g. Cruse 1977; Modreski & Goss 1969), generating a score of 100% correct for naming blue, although this clearly does not reflect the accurate referential application of this term.

In an attempt to overcome these methodological issues, we conducted an extensive study with preschool children to determine whether the developmental acquisition of basic colour terms is constrained by a fixed order that is analogous to the evolutionary order proposed by Berlin and Kay (1969). We measured the acquisition of knowledge of the full complement of eleven basic colour terms across four groups of preschool children aged between two and five years (Pitchford & Mullen 2002). Children were grouped according to their general language abilities, as assessed using a standardized measure of language functioning (including measures of both receptive and expressive

language skills), as our previous research (Pitchford & Mullen 2001) showed that grouping on the basis of language-age (LA) reduces the variance found when grouping on the basis of chronological-age (CA), although it does not qualitatively alter the pattern of results. Furthermore, we used the statistical measure of d′ (see Macmillan & Creelman 1991) as the dependent variable on which to compare results, as it takes into account the number of occasions a colour term is applied correctly in relation to the number of times a colour term is misapplied, thus accounting for biases in responding with particular colour terms. Two tasks of colour term knowledge were given to each child and the same stimuli were used in both tasks. The stimuli, shown in Figure 4, were focal examples of each of the eleven basic colour categories. The first task measured children's comprehension of the eleven basic colour terms using a spoken-word-to-colour-matching task and did not require a verbal response. Children were required to match a spoken colour word to one of three different

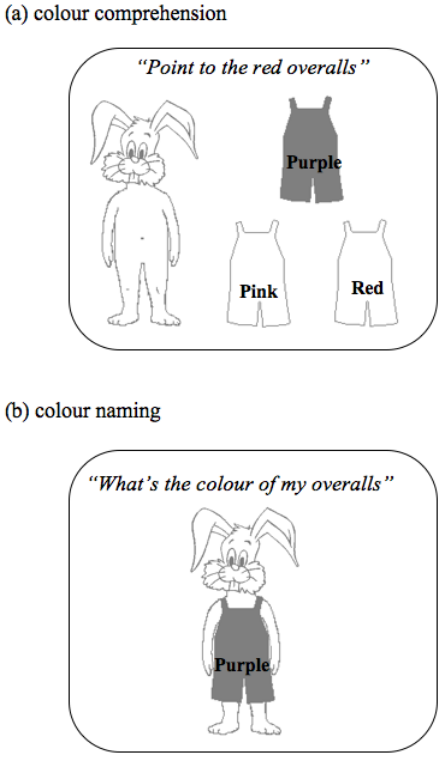

Figure 4: *Schematic illustration of the experimental stimuli used in Pitchford and Mullen (2002).*

colour samples, one of which was the target colour and the other two acted as distracter colours (see Figure 4a). The second task assessed children's production of the eleven basic colour terms and required children to orally name individually presented colour stimuli (see Figure 4b).

Our data showed only minimal support for a developmental order of colour term acquisition based on the evolutionary order proposed by Berlin and Kay (1969). We found no advantage for the primary colours on the comprehension task in any of the four LA-groups, as is clearly shown in Figure 5a. In contrast, we found a significant advantage for primary over non-primary colour terms on the colour naming task, but only for children with a language-age of three years (see Figure 5b). For the other age groups (two years and four and five years),

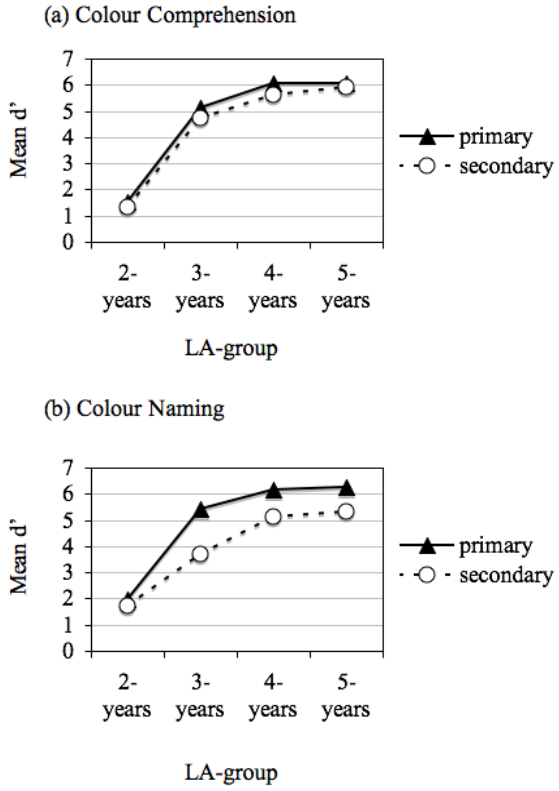

Figure 5: *Mean d' achieved on the tasks of (a) colour comprehension and (b) colour naming for preschool children with a language-age of 2 years, 3 years, 4 years and 5 years, from Pitchford and Mullen (2002). Maximum d' is 6.39.*

there was no significant advantage of naming primary colours compared to non-primaries. These results are consistent with previous studies that have found the advantage for primary colours to be task-specific, being only elicited in production tasks (e.g. Heider 1971; Andrick & Tager-Flusberg 1986). In addition, our data suggest the superior naming of primary over non-primary colours is also age-specific, being shown only by children with a language-age of three years.

More importantly, our data revealed a different developmental order of colour term acquisition. For each child, we combined their performance on the tasks of colour comprehension and colour naming to produce an overall measure of their receptive and expressive knowledge of each of the eleven basic categories. We then determined the mean language-age at which knowledge of a particular colour term became statistically reliable (that is, the point at which children correctly identified a particular colour term without applying it erroneously). Results revealed that children acquired an accurate knowledge of the basic colour terms in two distinct temporal periods; first, children acquired knowledge of nine of the eleven basic terms (*yellow, blue, black, green, white, pink, orange, red,* and *purple*), in any order, between 36 to 40 months. Second, children gained accurate knowledge of the remaining two basic colour terms, *brown* and *grey*, in either order, but only after a substantial gap of 6-9 months,

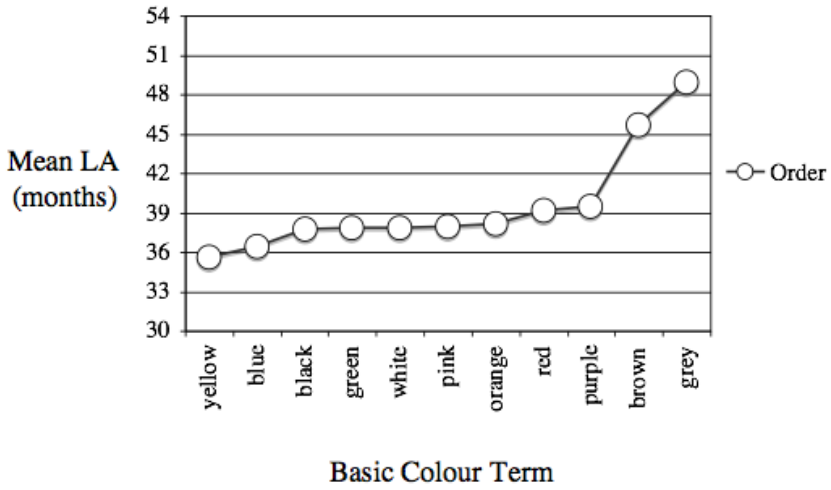

Figure 6: *Dichotomous developmental order of colour term acquisition found by Pitchford and Mullen (2002).*

at 46 to 49 months, as illustrated in Figure 6.

This dichotomous developmental order of colour term acquisition was replicated in a subsequent study (Pitchford & Mullen 2005) using separate tests of colour naming and colour comprehension, on two different groups of children. Consistent with our earlier study (Pitchford & Mullen 2002), we found that the acquisition of only the two non-primary colour terms, *brown* and *grey*, was delayed compared to the others, with the three non-primary colour terms (*purple, pink* and *orange*) and the six primary colour terms (*black, white, red, yellow, green* and *blue*) being acquired at a similar rate.

Thus, rather than a delayed acquisition of all five non-primary colour terms relative to the six primary colour terms, as suggested by Miller and Johnson-Laird (1976), we found evidence for a dichotomous developmental order marked only by a selective delay in the acquisition of *brown* and *grey***.** Aside from these two non-primary colour terms (*brown* and *grey*), the order by which the other nine basic colour terms are acquired appears to be unconstrained. This finding is consistent with recent cross-cultural studies suggesting that adult colour naming is unconstrained (Davidoff, Davies & Roberson 1999; Roberson, Davies & Davidoff 2000), and questions the assertion of Berlin and Kay (1969) that the developmental order of colour term acquisition is constrained by visual neurophysiology (see Roberson, Davidoff, Davies & Shapiro, in this volume). Instead, it raises the possibility that other factors may be important in shaping the acquisition process.

4. What factors help shape the developmental acquisition of basic colour terms?

In a series of experiments with two- to five-year-olds, we investigated what might constrain the acquisition of *brown* and *grey* relative to the other nine basic colour terms, by investigating the role of perception, language, and preference on the acquisition process (Pitchford & Mullen 2005).

4.1 *Does perception limit the acquisition of* brown *and* grey*?*

First, we investigated two possible ways in which a perceptual constraint may inhibit the developmental acquisition of *brown* and *grey*. In the first experiment, we investigated whether children could visually discriminate brown and grey because, in a previous study, we found that children often mistook brown for grey and vice versa on colour comprehension and naming tasks (Pitchford & Mullen 2003). Although infants develop colour vision within

the first few months of life (e.g. Maurer & Adams 1987; Teller 1998; Teller & Bornstein 1985), systematic comparisons across the range of basic colour categories have not been made. Thus it is possible that differences in the timing of the perceptual development of different categories may influence the rate at which they are conceptualized. We argued that, if the delayed linguistic acquisition of *brown* and *grey* arises from an underlying perceptual deficit, preschool children that cannot comprehend or name *brown* and *grey* should also confuse these two colours perceptually.

To test this hypothesis, we gave tasks of colour discrimination and colour comprehension to a group of preschool children aged two to three years. Colour discrimination was measured in a match-to-sample task that required one of two colour stimuli to be selected that was identical to a target colour. For example, a triangular display of three circles, two of which were brown and one grey, was shown to the child, and the experimenter pointed to one of the brown circles and said "See this. Can you show me the other one?", and the child responded by pointing to one of the other two circles. A similar stimulus display was used in the colour comprehension task, except three different colours were presented and the child was required to point to one in response to a colour name spoken by the experimenter ("Can you show me the brown one?"). Results showed that, consistent with our previous studies, children's comprehension of *brown* and *grey* was significantly poorer than their comprehension of the other nine basic colour terms, however, their ability to discriminate all of the basic colours was flawless. These results clearly illustrate that the relative delay in the linguistic acquisition of *brown* and *grey* does not reflect a perceptual deficit in discriminating these two colours.

In a second experiment, we investigated whether children found brown and grey to be less salient perceptually than the other basic colours. Children were given a preferential-matching task, similar to that used by Pitchford and Mullen (2001), in which they were shown a target stimulus, for example, a brown square, and were told, "See this, can you find another one?", after which two stimuli were revealed, one was consistent with the target in its colour (for example, a brown circle) and the other in its shape (for example, a grey square). The child was required to point to the stimulus that matched the target. We tested three different colour pairs across three separate conditions: (1) two primary colours (blue and green); (2) two non-primary colours (pink and purple) that are acquired at the same time as primary colours; and (3) the two non-primary colours (brown and grey) that are acquired late. As children's responses on this task indicate whether they match on the basis of colour or

shape, we compared the number of colour matches made across the three experimental conditions. Interestingly, we found that children made a similar number of colour-based matches across all three conditions (blue & green = 47%, pink & purple = 47%, brown & grey = 51%), indicating that the nature of the colour stimuli did not influence children's decisions to use colour as the basis for perceptual grouping. This suggests that, at a time when children have difficulty comprehending and naming brown and grey they will match objects on the basis of these two colours. Thus, brown and grey do not appear to be any less salient as colours to preschool children than the nine basic categories that are conceptualized earlier.

4.2 *Does linguistic input shape colour term acquisition?*

We next considered the role of language in the delayed acquisition of *brown* and *grey*, as previous studies have found that maternal input correlates significantly with colour naming ability in preschool children (Andrick & Tager-Flusberg 1988). We investigated whether *brown* and *grey* are significantly less frequent colour terms used by mothers when communicating with their young children compared to the other nine basic colour terms. We generated two objective counts of linguistic frequency for each of the eleven basic colour terms using: (1) books aimed at the preschool years, and (2) mothers' spoken interactions with their children. Mean written word frequency counts were generated by counting the number of occasions each of the eleven basic colour terms appeared in 374 different books designed to be read to preschool children. For the spoken frequency counts we used the Manchester corpus (Theakston, Lieven, Pine & Rowland 2001) from the CHILDES database (MacWhinney 2000) that includes thirty-four hours of continuous speech from each of twelve mothers recorded whilst interacting playfully with their children. All the children were aged between two and three years and were thus likely to be learning colour terms. For each of the mother-child interactions, we extracted the number of occasions each of the eleven basic colour terms were used by the twelve mothers, from which we generated a mean frequency count.

The two objective measures of colour term frequency generated from child-directed language correlated significantly ($r = .69$ ($n = 11$), $p = .02$), indicating a strong degree of concordance between these two measures. Interestingly, both measures of basic colour term usage in child-directed language consistently supported an advantage for primary over non-primary colour terms, which is consistent with the prediction made by Miller and Johnson-Laird (1976),

although our data shows that children acquire primary colour terms at the same time as the non-primaries, *orange, pink* and *purple* (Pitchford & Mullen 2002; 2005). Linguistic frequency may, however, contribute to the late acquisition of the colour terms *brown* and *grey* by preschool children, as these two colour terms were consistently found to be the least frequent across both measures of linguistic frequency (written and spoken counts).

In addition to linguistic input, other environmental or cultural factors have been shown to influence colour term acquisition. For example, Shatz et al. (1996) found attendance at preschool significantly improved colour term knowledge in two-year-olds. Furthermore, Zollinger (1988) showed that Japanese children were influenced by Western culture when learning to name non-primary colours, although this did not affect their naming of primary colours. Together, these results and our own data suggest that the linguistic environment to which the preschool child is exposed helps shape the order by which they acquire basic colour vocabulary.

4.3 *Does colour preference influence colour term acquisition?*

Finally, we explored whether colour preference may be related to the order in which children acquire basic colour terms. In particular, we sought to investigate whether children like brown and grey less than the other basic colours. Differences in preference for the eleven basic colours may influence their linguistic acquisition in several ways. For example, Zentner (2001) suggested children might focus their attention towards colours they prefer in their environment, which may, in turn, make these colours more memorable. Bornstein (1975) suggested that differences in colour preference might reflect underlying differences in the biological meaningfulness of particular colours, which may, in turn, facilitate colour term learning.

To investigate whether children's preferences for the eleven basic categories were associated with their linguistic development we gave a group of preschool children a task of colour preference and a task of colour naming. To test colour preference, we showed children a random display of the eleven basic categories and asked them to indicate which colour they liked the best. This colour was then removed from the display and the procedure was repeated until only one colour remained. The resultant order indicated the ranked colour preference order for each child. Results showed, as in our previous studies, that children named brown and grey significantly less than the other nine colours, and they also preferred brown and grey significantly less than the other colours. A significant, negative correlation was found between colour preference and

colour naming ($r = -.77$ ($N = 11$), $p = .004$). These results suggest that colour preference and colour naming are developmentally linked. Furthermore, children disliked brown and grey irrespective of whether or not they could name brown and grey accurately, illustrating that differences in colour preference are established before accurate knowledge of colour terms is acquired. This raises the possibility that colour preference may exert a direct influence on the process by which children acquire colour terms.

5. *Summary of research findings and conclusions*

Our investigations into the anomalies of colour term acquisition have revealed three key findings. First, we have questioned the claim that colour terms appear unusually late in lexical acquisition. Although colour terms may appear later than object names, we argued this might well be expected, given the differences in functional significance between colour terms and common nouns. However, when the lexical acquisition of colour terms is compared with that of other terms used to describe visual attributes, no selective delays are found (Pitchford & Mullen 2001). Second, we investigated whether colour term acquisition progresses through a fixed developmental order that is analogous to the evolutionary order proposed by Berlin and Kay (1969), as suggested by Miller and Johnson-Laird (1976). We found little support for a temporal advantage in the acquisition of primary compared to non-primary colour terms. Instead, our data revealed a dichotomous developmental order marked only by the late acquisition of *brown* and *grey* (Pitchford & Mullen 2002). Finally, we sought to investigate factors that may influence the acquisition of basic colour terms. Whilst perception did not appear to limit colour conceptualization, we found that linguistic input, colour preference, and colour naming are developmentally linked (Pitchford & Mullen 2005), although the nature of this association remains to be elucidated.

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