A practical field method for identifying probable basic colour terms[1]

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Abstract

We describe a quick and robust procedure for establishing likely basic colour terms. We illustrate the procedure with a study of English where the basic colour term inventory is known. The method consists of two tasks: an elicited list task (tell me as many colour terms as you know) and a colour naming task. The list task elicits contenders for the basic colour term slots and the naming task establishes their range of referents. The indicators of the degree of basicness of colour terms converged to confirm that there are eleven basic colour terms in English.

1. Introduction

Berlin and Kay's (1969) theory of colour term universals has been very influential and its generality continues to be tested by a wide range of field studies (see for example MacLaury, 1991, Senft, 1987). The main aim of this paper is to describe a quick, simple and robust method of establishing the likely 'basic' colour terms of a language. The method was designed to be used in the field, rather than in the laboratory; it requires no equipment other than a standard set of colour 'tiles' and a moderate degree of control over how they are presented. We have used the method in various locations in rural southern Africa (see for example Davies et al, 1992, for a field study in Botswana) but in this paper we describe using the method on English speakers in Britain; it is generally accepted that English has eleven basic colour terms (Berlin and Kay 1969, Boynton and Olson 1987) and thus applying the method to English provides a test of the reliability and validity of the method. Before describing the procedure, we outline Berlin and Kay's theory with particular emphasis on the idea of basicness of colour terms, and secondly, of the distinction made within basic colour terms, between primary and derived basic colour terms.

According to Berlin and Kay (1969), all languages have basic colour inventories drawn from the set of terms shown on the hierarchy in figure 1. The hierarchy constrains possible sets of basic colour terms synchronically and diachronically: if the theory is correct, then any language must have a 'permitted' set of colour terms, and the colour term inventory of all languages evolved, or will evolve, according to the left to right sequence on the hierarchy. All languages start with two terms: black and white (dark and light); they next acquire a term for red; then a term for either green or yellow; then whichever was missing of green and yellow; and so on up to the theoretical maximum of eleven basic colour terms: all the terms in figure 1.

The criteria for a term to be basic as originally set out by Berlin and Kay were that they be: mono-lexemic (their meaning is not derivable from their parts) which would eliminate terms like *lemon-coloured*; that their meaning was not included in the meaning of a superordinate colour term (thus scarlet is not basic because it is wholly included in *red*); their range of referents should be unrestricted (thus *blond* is not basic); and the terms should be

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psychologically salient. These criteria have been criticised on a variety of grounds, Crawford (1982), Moss (1989) Ratner (1989), but for the purposes of this paper we will accept the original criteria.

There have been several major developments to the theory since its inception (see Kay, Berlin and Merrifield, 1991, for a concise statement of their current position). For our current purposes the most important development is the distinction made between 'primary' basic colour terms - the first six terms in the hierarchy, and 'derived' basic colour terms - the remaining five terms (Kay and McDaniel 1978). This distinction is based in part, on the neuro-physiology of colour vision, which suggested that the colours denoted by the primary terms were fundamental neurologically. The six primary colours seemed to be represented by three neural channels each of which represented one opponent-pair of colours in a manner consistent with Hering's (1920) theory of colour vision (see Jameson, 1985, for a recent account of the neuro-physiological support for Hering's theory, and De Valois and De Valois, 1993, for a neural model consistent with Hering's theory). Derived colours are perceptual 'blends' of two primary colours; for example, orange is a blend of red and yellow.

English has the eleven basic terms shown on the hierarchy, which is of course consistent with the predictions of the theory. We should investigate whether the terms to the left retain their 'more basic' status to some extent, even when other terms have been added (see, for example Boster, 1986 and Corbett and Davies, 1994 for evidence from a range of languages). Even if the full ordinal structure of the hierarchy is not reflected in the relative basicness of the eleven terms, it is possible that the distinction between primary basic and secondary basic terms is reflected in measures of basicness.

The original Berlin and Kay method for establishing basic colour terms, consisted of eliciting contenders for the basic colour terms slots from informants, then 'mapping' their referents in a set of 330 Munsell chips, and finally asking respondents for the best example of each colour term. A minimum requirement for the consensus criterion is that there should be good agreement over the foci - the best examples - of basic colour terms, whilst variation in the boundaries of the categories is acceptable.

The Berlin and Kay procedure has been adapted by MacLaury (1991) for use in the field. His 'rice mapping' procedure requires an informant to place a grain of rice on each exemplar of a colour term in the same Munsell array as used by Berlin and Kay, in order to map the domain of referents of each term. Repeated mapping with instructions (by implication at least) to use laxer criteria for inclusion are undergone successively until the informant is unwilling to include further chips in the category. The procedure is an effective way of mapping the referents of a term, and it lays particular emphasis on seeking overlap and possible inclusions between terms. The drawbacks are that it takes a considerable time with each informant and that whilst it is an effective way of establishing how the informant uses colour terms, it is relatively cumbersome to establish the degree of consensus across speakers.

Boynton and Olson (1987, 1990) and Uchikawa and Boynton (1987) developed a colour naming procedure which required subjects to name each of the 424 OSA colour samples as quickly, as possible. The samples were presented twice each under controlled laboratory conditions, which as well as controlling the illuminant, permitted the measurement of naming

time - the time from the on-set of the stimulus to the start of the subject's vocalisation. Measures of naming time, consensus across individuals, consistency within individuals, and frequency of use were extracted, and the domain of referents within OSA colour space was established for each contender for the basic colour terms slots. The various measures converged to support the contention that English and Japanese had eleven basic colour terms, consistent with figure 1. Basic terms were produced quickly, frequently, consistently and with high consensus; and sufficiently so, to separate them from the non-basic terms. The procedure is reliable and useful, but it requires laboratory conditions, and because it takes a relatively long time to administer, it is only suitable for small numbers of individuals. We have used Boynton and Olson's method on Russian speakers (Moss, Davies, Corbett and Laws 1990) and the results suggest the same inventory of basic colour terms as indicated by linguistic analysis (Vamling 1986, Corbett and Morgan 1988). However, the shorter procedure we are about to describe gives essentially the same pattern of results (Davies and Corbett 1994).

The procedure we have adopted is based on Berlin and Kay's original procedure. We use a term elicitation task to elicit contenders for the basic term slots, and then a mapping procedure on a restricted set of just 65 colour tiles. We use the frequency with which terms are offered across informants in the list task as our primary measure of salience, rather like Battig and Montague (1969), and we extract a variety of descriptors from the mapping task as indicators of consensus across informants, and prevalence of use, as well as using it to establish the referents of each term. The whole procedure lasts about 15 to 20 minutes, thus allowing us to test relatively large numbers of informants.

2. Method

Subjects

There were forty-seven subjects in total, twenty-four men and twenty-three women whose ages ranged from twenty-one to sixty-five years with a mean of twenty-nine years. All were native speakers of English.

Stimuli

The stimuli in the naming task were sixty-five coloured 'tiles'. Each tile was five cm square and 0.4 cm thick and consisted of a rigid wooden base covered with coloured paper selected from the Colour-Aid corporation range of colours. The colours formed a coarse, but evenly spread sample of colour space. Their Colour-Aid codes and CIE coordinates are shown in table 1, and their distribution in CIE chromaticity space shown in figure 2 (see Newhall, Nickerson and Judd, 1943, for tables that convert CIE coordinates into Munsell codes). Figure 2 also includes the loci of the eleven 'universal' colour foci - the best examples of the eleven universal terms - taken from Heider (1971).

Procedure

All subjects did the list task first. They were asked to write down as many colour terms as they knew, in columns so that the order they wrote them in could be extracted. The maximum time allowed was five minutes, but in practice most subjects finished within two minutes. In the tile naming task subjects were shown one tile at a time in a random sequence and asked to name the tile; subjects were allowed to say they did not know a suitable term. The tiles were shown on grey cloth, in natural daylight, indoors, avoiding direct sun light or deep shade. The experimenter recorded the subject's response, removed the tile and then

displayed the next tile, and so on until all sixty-five tiles had been displayed. The tile naming task lasted about fifteen minutes.

3. Results

The list task

The mean number of terms offered was 18.3 and the lists ranged in length from 9 to 31 terms. Overall 125 different terms were offered. Table 2 shows each term that was offered by five or more people, the frequency with which it was offered, and the mean list position for each term.

It can be seen (from the frequency column) that the eleven basic terms are the eleven which were offered most frequently. The least frequent basic terms - *brown* and *pink* - scored 36, while the most frequent non-basic term - *turquoise* - scored 30. Within the basic terms, the primary basic terms have higher frequencies than the derived basic terms, with the exception of *orange*, which scores higher than all terms except *green* and *blue*. When we turn to the position measure (the mean position of the term on subjects' lists), we see that the situation is less clear cut. Most of the basic terms have higher mean positions than the non-basic terms, but several non-basic terms - *turquoise*, *mauve*, *violet*, and *indigo* - have higher mean positions than the basic terms, *brown* and *grey*. Thus, although *turquoise* was included by fewer subjects than was *brown*, it occurred on average in a higher position than *brown*. Within the basic terms, the chromatic primary terms - *red*, *green*, *yellow* and *blue* - have the four highest list positions, but the achromatic terms - *black* and *white* - have scores similar to the derived terms. *Red* is notable in that over half of the sample - 25 people - gave it as their first term; the next highest score for the number of first places was for *blue*, which scored 10; no other term scored higher than two.

Tile naming

Overall there could have been 3055 responses (65 tiles by 47 subjects). There were in fact 2908 responses because on 147 occasions (about 5% of possible responses) subjects were unable to produce a name they were satisfied with. There were just two tiles - ROR S3 and RVR S1 - which were named by fewer than 40 subjects. Table 3 shows the most frequent term given for each tile, the second most frequent term, where there was one, together with their respective frequencies where these were greater than three.

It can be seen that the most frequent term is almost always a basic term; there are just five exceptions to this pattern: ORO T3, *orange* and *peach* have equal scores; VBV T4, *lilac* is the most frequent term; O S1, *tan* is the most frequent term; RVR S1, *mauve* has the same frequency as *purple*; and BVB S3, *lilac* is the most frequent term. Overall basic term responses made up 71% of all responses. The general pattern is for a basic term to be the most frequent term, and a non-basic term to be the second most frequent term. Where two basic terms are the two most frequent terms, they tend to be perceptual neighbours, such as *yellow* and *orange* (YOY HUE, YO HUE, YO T3) or *blue* and *purple* (VBV HUE, BV HUE, BVB HUE).

Table 4 shows all terms that were used more than 15 times in total, and the total number of

times with which they were used; the terms are ordered by their frequencies.

It can be seen that each basic term, except *white*, scores higher than every non-basic term. *White* has a frequency of 50, which is lower than the frequency for *mauve* (92), and only one higher than that for *turquoise* (49). Column 3 of table 4 shows the number of tiles for which each term was the most frequent term. Each basic term is the most frequent term for at least one tile, and just three non-basic terms - *mauve*, *lilac* and *tan* - have scores greater than zero. Columns four and five show more stringent indicators of agreement across respondents, the 'dominance' indices. Column four gives the number of tiles for which more than half the respondents used a given term, and column five gives the number of tiles for which over three quarters of respondents used a given term. It can be seen that each basic term has at least one tile for which it is dominant according to both criteria, and no non-basic term has a tile for which it is dominant on either criterion. *Green*, followed by *blue* have the highest dominance indices, but otherwise there is no tendency for the primary basic terms to have higher scores than the derived basic terms. *Red* is unusual in that a subordinate red term - either *scarlet* or *crimson* - is the second most frequent term for three tiles (RO HUE, ROR HUE, and R HUE); if the subordinate term score was added to the score for red, then red would score two higher on the first dominance index and one higher on the second.

Figure 3 shows the loci of the colours denoted by the dominant terms (greater than 75% of the sample used the same term) in table 4 in CIE chromaticity space.

It can be seen that each of the eight chromatic terms occupies a separate and non-overlapping region of the space. The achromatic terms are superimposed in the x, y, plane but are separated on the Y coordinate.

4. Discussion

Our measures converge to indicate that the eleven terms in figure 1 are the basic terms of English. They were the eleven most frequent terms on the list task; in general they tended to occur relatively early in the lists; they made up almost three-quarters of the total responses in the naming task and ten of them - the basic terms except *white* - were the ten most frequently used terms; each of the basic terms was used by over three-quarters of the sample to name at least one colour, and no non-basic term was so used. Each basic term shows high salience and high consensus, and within the limits of resolution of our mapping procedure, occupy non-overlapping regions of colour space. The loci of the dominant terms in CIE chromaticity space are close to their respective universal foci (figures 2 and 3) although our stimuli tend to be rather less saturated than the universal foci.

In general our procedure did not produce the degree of consensus across respondents achieved by Boynton and Olson (1987). This was probably because our subjects were under no time pressure, and many of them deliberated over the exact name for a particular colour. They thus produced terms such as *mandarin*, or *daffodil*, whereas under time pressure they might well have responded *orange* or *yellow*. Such deliberation has not been a problem in our studies of languages of southern Africa; in these cases the problem has often been to find any apt colour term rather than having a choice from several alternatives.

We knew in advance that the basic colour terms of English were the eleven terms in figure 1. If we were studying a language whose basic colour term inventory was unknown, then it is unlikely that our method on its own would be sufficient to establish for certain what the basic colour terms were. This is because there is no necessity for there to be a sharp cut off on our measure between basic and non-basic terms. Even as colours have graded membership in colour categories, so colour terms vary in their degree of basicness; our measures are indicators of the degree of basicness and their main purpose is to identify the strong contenders for the basic slots. The procedure requires supplementing by linguistic analysis, to corroborate the results. It also needs an additional mapping task with less coarse sampling of colour space, in order to determine precisely the foci and boundaries signified by each term, and to be certain that no term is included within the domain of another. Nevertheless, it is simple, relatively quick to carry out, and is robust.

Figures & tables

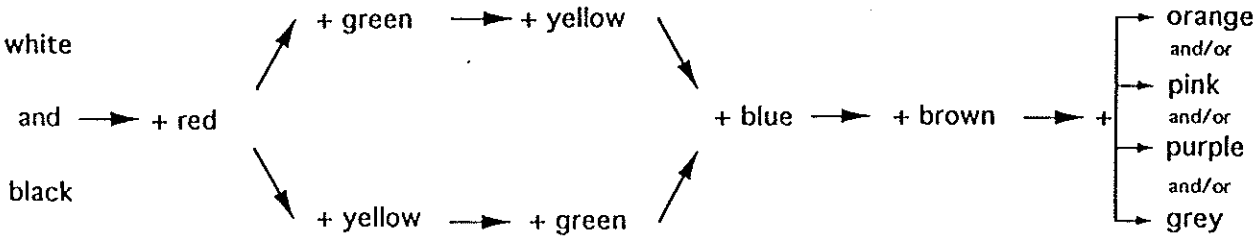

Figure 1:
The Berlin and Kay Hierarchy of Basic Colour Terms

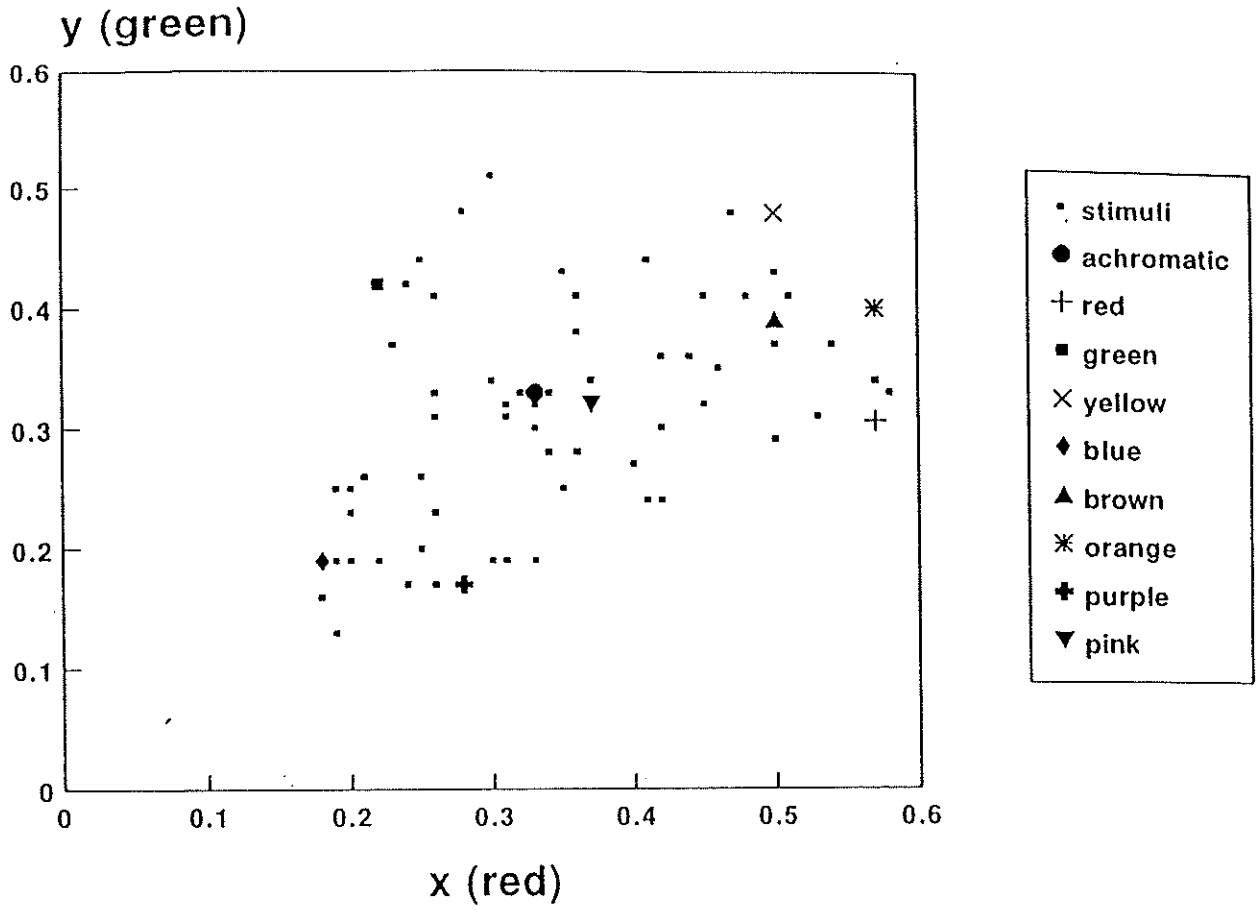

Figure 2 : Loci of the colour samples and the universal foci in CIE space

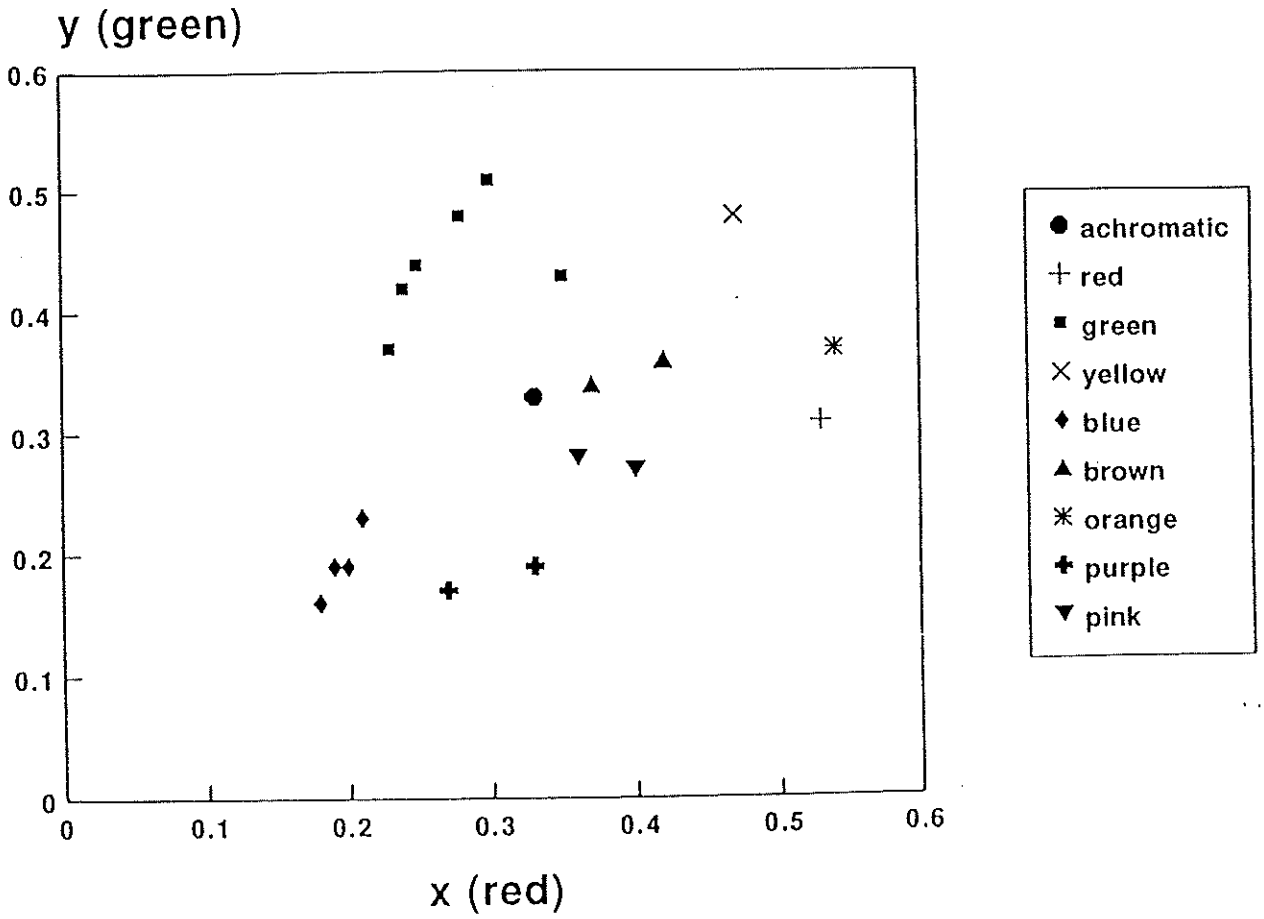

Figure 3 : Loci of colour samples named with high consensus

Table 1:
Color-Aid codes and CIE coordinates for the tile-colours

Color-Aid code		CIE coordinates		
		Y	x	y
Y	HUE	64.77	.47	.48
	S2	16.99	.41	.44
YOY	HUE	47.48	.50	.43
	T4	55.63	.45	.41
	S2	22.08	.36	.38
YO	HUE	39.52	.51	.41
	T3	47.02	.48	.41
	S3	10.72	.36	.41
OYO	HUE	26.51	.54	.37
O	HUE	25.00	.54	.37
	S1	14.34	.50	.37
	S3	9.15	.42	.36
ORO	HUE	18.87	.57	.34
	T3	36.88	.46	.35
	S3	26.51	.33	.32
RO	HUE	16.22	.58	.33
	T3	32.66	.45	.32
	S3	4.19	.37	.34
ROR	HUE	15.23	.53	.31
	T3	29.82	.42	.30
	S3	20.71	.34	.28
R	HUE	11.71	.50	.29
	T4	24.34	.40	.27
	S3	4.81	.33	.30
RVR	HUE	9.11	.42	.24
	S1	12.79	.35	.25
	S3	28.43	.36	.28
RV	HUE	6.97	.33	.19
	T2	14.51	.31	.19
VRV	HUE	6.71	.30	.19
	S3	28.42	.36	.28
V	HUE	4.67	.26	.17
VBV	HUE	4.13	.24	.17
	T4	19.05	.25	.20
BV	HUE	4.21	.22	.19
	S2	7.88	.25	.26
BVB	HUE	4.80	.19	.13
	S3	26.65	.26	.23
B	HUE	9.51	.18	.16
	T1	19.02	.20	.19
BGB	HUE	9.62	.19	.19
	T3	23.08	.20	.23

BG	HUE	8.93	.20	.25
	T1	16.57	.19	.25
	S2	7.42	.21	.26
GBG	HUE	10.69	.23	.37
	S2	20.79	.20	.25
G	HUE	11.99	.24	.42
	S3	6.10	.26	.33
GYG	HUE	12.89	.25	.44
	T4	31.14	.26	.41
	S1	15.59	.26	.31
YG	HUE	14.66	.28	.48
	S3	5.78	.30	.34
YGY	HUE	18.92	.30	.51
	S3	35.87	.35	.43
ROSE RED		17.63	.41	.24
SIENNA		13.31	.44	.36
WHITE		81.40	.32	.33
GRAY1		47.55	.32	.33
GRAY2		30.59	.32	.33
GRAY4		18.88	.31	.31
GRAY6		11.20	.31	.31
GRAY8		4.53	.31	.32
BLACK		3.59	.34	.33

Table 2: List task.
Frequency and mean position of all terms offered by more than five people.

Term	Frequency	Position	Term	Frequency	Position
White	42	9.8	Silver	14	16.2
Black	42	8.1	Navy	11	17.4
Red	43	2.5	Cerise	8	12.0
Green	45	5.0	Aquamarine	8	17.5
Yellow	43	4.5	Scarlet	8	11.9
Blue	45	2.9	Crimson	7	16.3
Brown	36	11.5	Maroon	7	11.0
Purple	39	8.8	Peach	7	14.4
Pink	36	8.8	Emerald	7	16.6
Orange	44	9.1	Olive	6	17.8
Grey	37	12.4	Lime	6	17.2
Turquoise	30	9.5	Lemon	6	14.0
Mauve	26	10.9	Sienna	6	16.8
Beige	20	14.1	Fawn	6	16.5
Violet	19	10.3	Magenta	6	16.5
Cream	17	15.6	Ochre	5	12.6
Indigo	16	9.6	Sage	5	16.2
Gold	16	16.6			

Table 3: Naming task. Distribution of responses across the sixty-five tiles.
(Code = Color-Aid code; F. = frequency that a term was used for a given tile.)

Code		Terms	F.	Code	Terms	F.	Code	Terms	F.
Y	HUE	yellow	42	S2	green	29			
					khaki	8			
YOY	HUE	yellow	29	T4	yellow	35	S2	green	26
		orange	8					khaki	13
YO	HUE	yellow	20	T3	yellow	28	S3	khaki	10
		orange	17		orange	11		green	4
OYO	HUE	orange	38						
O	HUE	orange	39	S1	tan	20	S3	brown	43
					brown	16			
ORO	HUE	orange	20	T3	orange	10	S3	grey	14
		red	13		peach	10		taupe	9
RO	HUE	red	30	T3	pink	22	S3	brown	38
		scarlet	8		peach	13			
ROR	HUE	red	37	T3	pink	33	S3	pink	15
		scarlet	6					mauve	8
R	HUE	red	22	T4	pink	37	S3	brown	12
		crimson	6					black	8
RVR	HUE	pink	10	S1	mauve	9	S3	pink	37
		crimson	6		purple	9			
RV	HUE	purple	37	T2	purple	15			
		mauve	8						
VRV	HUE	purple	34				S3	pink	37
		mauve	7						
V	HUE	purple	37						
VBV	HUE	purple	28	T4	mauve	21			
		blue	9		lilac	13			
BV	HUE	blue	30				S2	blue	29
BVB	HUE	blue	35				S3	lilac	19
		purple	7					mauve	16
B	HUE	blue	39	T1	blue	43			
BGB	HUE	blue	40	T2	blue	39			
					turquoise	5			
BG	HUE	blue	29	T1	blue	30	S2	blue	28
		aqua'	7		turquoise	12		aqua'	6
GBG	HUE	green	43				S2	blue	28
								turquoise	12
G	HUE	green	43				S3	green	42
GYG	HUE	green	42	T4	green	38	S1	green	14
								grey	10
YG	HUE	green	44				S3	green	26
								grey	6
YGY	HUE	green	41				S3	green	40
BLACK		black	42	GRAY8	black	43	GRAY6	grey	40
GRAY4		grey	46	GRAY2	grey	45	GRAY1	grey	39
WHITE		white	47	ROSE	pink	26	SIENNA	brown	30
					cerise	8		tan	11

Table 4: Naming task.
Frequency and dominance scores.

Term	Frequency	DI mf	DI > .5	DI > .75
White	50	1	1	1
Black	100	2	2	2
Red	102	3	3	1
Green	451	12	11	8
Yellow	154	5	4	1
Blue	357	11	10	4
Brown	139	4	3	2
Purple	191	5	4	2
Pink	190	7	4	3
Orange	147	3	2	2
Grey	187	6	4	4
Turquoise	49	0		
Mauve	92	1	0	
Lilac	44	1	0	
Peach	25	0		
Aquamarine	23	0		
Tan	33	1	0	
Violet	23	0		
Khaki	31	0		
Crimson	16	0		

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