	ULINGAN	Kumilan Family	ikia
*	URIA	ISOLATE	bli, blɪk
	URIGINA	Peka Family	kamin
	USINO	Peka Family	itʌ
	USU	Nuru Family	tɛmul
	UTU	Hanseman Family	ɔg::
*	WADAGINAM	ISOLATE	uŋgi:g^{ə}nʌmp
	WAFFA	Eastern Family	yéekaana
	WAHGI	Central Family	'ndók
	WAIBUK	Waibuk Family	hamb^{w}u'mʌl
	"	"	hau
	WALIO	Walio Family	sosikalʌ
	WAMAS	Hanseman Family	kukunai
	WANAMBRE	Tiboran Family	mʌkɛl
	WANDAMEN	Geelvink Bay Sub-Group	ròswai
	"	"	wagĕrini, wangirïni
*	WANTOAT	Wantoat Family	ngwak
	WANUMA	Numagenan Family	mʌmur
*	WARIS	Waris Family	kɨl
	"	"	kuke
*	WAROPEN	Geelvink Bay Sub-Group	koidoanino
*	WASKIA	Kowan Family	kari
	YABEN	Numagenan Family	maibʌn
*	YABIO	Walio Family	ʌroma
	"	"	emene
	YABIYUFA	East-Central Family	osulepa
	YABONG	Yaganon Family	dɔku
*	YAGWOIA	Angan Family	nable
*	YANGULAM	Nuru Family	anma
*	YAQAY	Yaqay Family	qarò
*	YARAWATA	Numagenan Family	maiban
*	YIMAS	Pomoikan Family	k^{h}ʌlayn
	"	"	k^{h}uk^{h}ʌlak
	YOIDIK	Hanseman Family	gadan
	YONGGOM	Ok Family	kot
*	YOTAFA	Yotafa Sub-Group	oem
	ZIMAKANI	Boazi Family	wewe

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A Statistical Approach to Determining Basic Color Terms: An Account of Xhosa

We report a field study of the color terms of the Bantu language Xhosa. This was carried out to describe the Xhosa color term inventory, and particularly to establish which terms were basic, as a test of Berlin and Kay's theory of color universals. Our informants were from rural Transkei and performed two main color tasks: elicited lists ('tell me as many color terms as you know') and a color-naming task. Statistical indicators of salience and of consensus of use for each color term were derived from performance on the two tasks, and the range of referents of each term established. Our results indicate that Xhosa has basic color terms for white, black, red, yellow, and grue (green with blue), and as such is consistent with Berlin and Kay's theory.

Languages vary in the number of color terms in their inventories, but rather than "varying without constraint," according to Berlin and Kay (1969) all color term inventories are drawn from a severely restricted subset of all possible color terms. Figure 1 shows the Berlin and Kay hierarchy that represents *permissible* combinations of *basic* (the most important) color terms.

According to the theory, if a language has *n* basic color terms, then these should be the first *n* terms counting from the left on the hierarchy. For

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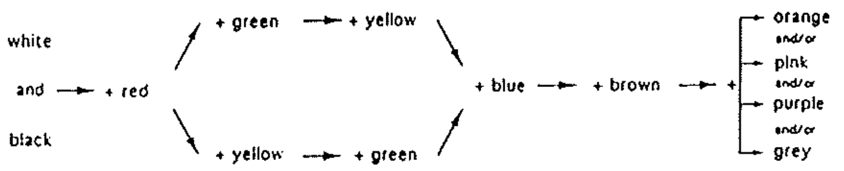

Figure 1
The Berlin and Kay hierarchy of basic color terms

example, if a language has just two basic color terms, then these should be white and black, and if a language has three color terms, then these should be white, black, and red. The theory does not specify a unique set of color terms for every value of *n;* for example, a four-term language could have either green or yellow, in addition to the terms for a three-term language.

As well as the synchronic predictions outlined above, the theory also makes diachronic predictions about the evolution of color term inventories. All languages must have a *permissible* set of basic color terms and can acquire new terms only in the order specified by the hierarchy.

The concept of basic color term is central to the theory. Basic color terms are neatly characterized by Hardin and Maffi (in press) as general and salient. A term is general if it can be used for a wide range of objects and its meaning cannot be subsumed under that of another basic term. For a term to be salient it must be readily elicitable, it must be found in the idiolects of all speakers, individuals must use it consistently, and there must be a high degree of consensus among individuals. Basic color terms must be drawn from the hierarchy, whereas languages may show considerable variation in their nonbasic color terms. Berlin and Kay's concept of basicness has been critized as unnecessarily restrictive by Crawford (1982), Moss (1989), and Ratner (1989), but all agree that basic terms should be salient; the measures we report here focus on salience as outlined above.

The concept of basicness of color terms fits with Rosch's (1973) idea of the *basic* level of categorization. According to Rosch, natural categories have graded degrees of membership rather than all-or-nothing membership. Basic color categories share this property of varied strength of category membership. Focal colors are the best exemplar of color categories and correspondingly, color universals are universals of the foci of categories, whereas there is much more variability in the boundaries of categories. Good agreement over the category focus, therefore, is a necessary condition for a category to be basic.

The theory has developed in a number of ways since it was first proposed, but for our current purposes, the most important modification was the distinction drawn between primary, composite, and derived color categories by Kay and McDaniel (1978). This distinction rests in part on the neurophysiology of color vision and on Hering's (1964[1920]) theory of color perception (see Jameson 1985). The color-pairs black and white, red and green, and blue and yellow have a fundamental status in Hering's

theory and appear to have privileged neurophysiological status. According to Kay and McDaniel, primary color categories are those designated by the first six terms in the hierarchy; derived categories are those designated by the remaining five terms. Composite categories are combinations of two or more primary categories, for example blue-with-green. Kay and McDaniel argued that languages with fewer than six basic color terms included at least one composite category in their inventories. Thus, if a language is without one of the primary terms, colors designated by the missing term are subsumed under a composite category. For example, many languages without separate terms for blue and green have a composite term—*grue*—that refers to blue-with-green (see, for example, Davies et al. 1992, on Setswana). According to Kay and McDaniel, the evolution of color term inventories consists of successive decomposition of composite categories, followed by *infilling* between the primary categories: for instance, orange is the infill at the intersection of red and yellow. The differentiation of color categories into composite, primary, and derived led to new versions of the original hierarchy in which early terms in the hierarchy could be composite terms (see Kay 1975 and Kay et al. 1991), but bearing in mind the possibility that some Xhosa categories might be composite, the hierarchy illustrated in Figure 1 is sufficient for our current purposes.

Although exceptions to the theory have been found, most languages studied since 1969 have been consistent with the theory to at least a *first approximation* (see, for example, Senft 1987 for a careful field study). Exceptions to the theory and an attempt to accommodate them in a new version of the theory are given in Kay et al. 1991. However, the most intensively studied languages have been the languages of North and Central America. Some of the languages of Africa were included in the original monograph, but in general the descriptions were based on relatively few informants. We have described Setswana, the main language of Botswana (Davies et al. 1992), which is a minor exception to at least the original version of the theory, in that it has a term for brown, although the grue category has not yet split into separate blue and green terms. The work we report here is a study of Xhosa, one of the major languages of South Africa, using similar behavioral procedures to those used in the Setswana study. Xhosa and Setswana are closely related; both are Central Bantu languages of Zone S (Ruhlen 1987:316).

The most common procedures for establishing basic color categories are based on Berlin and Kay's original method. This consisted of eliciting contenders for the basic color 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 color. The procedure has been adapted by MacLaury (1991) for use in the field. 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 several hours with each informant and that, while it is an effective way of establishing how the informant uses color terms, it is relatively cumbersome to establish the degree of consensus across speakers.

YO, and OYO are the intermediate hues between Y and O. In addition to the hues there are seven variants of each hue consisting of four *tints* T1 to T4, and three *shades* S1 to S3; the tints have increasing amounts of white added to the hue as their index number increases, whereas the shades have increasing amounts of black added as their index number increases. In addition, there is also a gray-scale and a number of colors of particular significance to painters. The subset of the Color-Aid range selected for the experiment consisted of all the hues and approximately one shade and one tint of each of the hues, plus five colors from the gray-scale (see Table 1).

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

Color-Aid code[2]		CIE coordinates	
	Y brightness	*x* redness	*y* greenness
Y	64.77	.47	.48
S2	16.99	.41	.44
YOY	47.48	.50	.43
T4	55.63	.45	.41
S2	22.08	.36	.38
YO	39.52	.51	.41
T3	47.02	.48	.41
S3	10.72	.36	.41
OYO	26.51	.54	.37
O	25.00	.54	.37
S1	14.34	.50	.37
S3	9.15	.42	.36
ORO	18.87	.57	.34
T3	36.88	.46	.35
S3	26.51	.33	.32
RO	16.22	.58	.33
T3	32.66	.45	.32
S3	4.19	.37	.34
ROR	15.23	.53	.31
T3	29.82	.42	.30
S3	20.71	.34	.28
R	11.71	.50	.29
T4	24.34	.40	.27
S3	4.81	.33	.30
RVR	9.11	.42	.24
S1	12.79	.35	.25
S3	28.43	.36	.28
RV	6.97	.33	.19
T2	14.51	.31	.19
VRV	6.71	.30	.19
S3	28.42	.36	.28

(continued on next page)

Table 1—*Continued*

Color-Aid code		CIE coordinates	
	Y brightness	*x* redness	*y* greenness
V	4.67	.26	.17
VBV	4.13	.24	.17
T4	19.05	.25	.20
BV	4.21	.22	.19
S2	7.88	.25	.26
BVB	4.80	.19	.13
S3	26.65	.26	.23
B	9.51	.18	.16
T1	19.02	.20	.19
BGB	9.62	.19	.19
T3	23.08	.20	.23
BG	8.93	.20	.25
T1	16.57	.19	.25
S2	7.42	.21	.26
GBG	10.69	.23	.37
S2	20.79	.20	.25
G	11.99	.24	.42
S3	6.10	.26	.33
GYG	12.89	.25	.44
T4	31.14	.26	.41
S1	15.59	.26	.31
YG	14.66	.28	.48
S3	5.78	.30	.34
YGY	18.92	.30	.51
S3	35.87	.35	.43
ROSE RED	17.63	.41	.24
WHITE	81.40	.32	.33
SIENNA	13.31	.44	.36
BLACK	3.59	.34	.33
GRAY 4	18.88	.31	.31
GRAY 6	11.20	.31	.31
GRAY 8	4.53	.31	.32

The City University Colour Vision Test (Fletcher 1980) was used for assessing color vision. This is a quick and simple test of color vision, which requires no literacy and produces a preliminary indication of any color vision anomalies. It produces estimates of the extent of the relatively common anomalies, protanopia and deuteranopia (red-green anomalies) and of the much rarer anomaly, tritanopia (blue-yellow anomaly). The test consists of ten *plates*, each consisting of a color spot and four surrounding spots; the task is to point to the surrounding spot that is most like the center spot.

Language and Instructions

For each task, the English instructions were translated into Xhosa by a native speaker of Xhosa, and back-translated into English by another native Xhosa speaker. Some minor adjustments were made to the instructions on the basis of the back-translation, and the cycle repeated. The fit between the original instructions and the back-translation was satisfactory after the second cycle. The experiment was carried out by a native Xhosa speaker, and all spoken communication took place in Xhosa.

Procedure

All subjects did the tasks in the following order: lists, City University Colour Vision Test, color grouping, color naming. The color grouping task required the subjects to sort the tiles into groups on the basis of their similarity; this task was included as part of a large cross-cultural study of the effect of language on color perception, which we report elsewhere. The experiment took place outdoors in light shade. Subjects were tested individually and given a small gift for participating.

In the list task, they were asked: "Please tell me as many color terms as you know." The experimenter wrote down their responses, encouraged them to continue if they paused, and moved on to the next task when they said that they had finished. The task generally took less than two minutes. In the City University test they were shown one plate at a time and asked to point to the color most like the one in the middle. This task generally took about two to three minutes. In the color naming task, they were shown each of the 63 tiles, one at a time, on a piece of gray cloth, in a different random order for each subject.[3] They were asked, "What do you call this color?" All responses, including "don't knows" were recorded. The naming task took about five to ten minutes.

Results

Color Vision

Twenty of the sample showed mild tritanopia (tritanomaly); that is, they made a small number (generally between one and three) of tritanopic errors, rather than the eight or more errors characteristic of congenital tritanopia. As there were no demographic or performance differences, other than the color vision test, that distinguished the tritanomalous from the rest of the sample, their data has been analyzed along with that of the whole sample.

Lists

On average, respondents offered 5.3 terms per list. However women offered more terms on average than men: the mean scores were 5.9 and 4.5 for women and men respectively. This difference is statistically significant: $t = 3.4$; $d.f. = 42$; $p < .002$.

There were 22 different terms offered in total, but nine of these were offered just once each. These low frequency terms included six 'cattle' terms, for instance *bhonte* 'black and white spotted.' These terms are restricted to describing cattle appearance, and they often denote color mixtures, rather like *piebald* in English.

The 13 terms that were each offered by two respondents or more are given in Table 2, ordered by the number of respondents that offered each term. Table 2 also gives the mean across respondents, for each term, of the order that the terms were given in. Most of the terms are traditional Xhosa terms, but there are also a number of terms whose roots are borrowed from English: *tyheli* 'yellow,' *blue* 'blue,' and *pinki* 'pink.' The first five terms: *mhlophe* 'white,' *mnyama* 'black,' *bomvu* 'red,' *hlaza* 'green with blue' (grue), and *tyheli* 'yellow' were offered by two-thirds of the sample or more. The next most frequent term, *mdaka* 'brown,' was offered by almost half the sample, but the remaining terms were offered by about a quarter of the sample or less. The most frequent terms also tend to be offered earlier than the less frequent terms, as indicated by their low mean position scores.

The rank orders in Table 2 fit the Berlin and Kay hierarchy well. The five most frequent terms form a "permissible" combination for a five-term language; strictly the scores for 'white' and 'black' should be greater than for 'red,' but this discrepancy in the scores is small. However, the sixth highest term is *mdaka* 'brown,' and its frequency is substantially higher than that for *blue*. The position of *mdaka* 'brown' is inconsistent with the hierarchy, and according to Kay and McDaniel, a brown term should not appear until the decomposition of grue is complete.

Table 2
List task. Frequency and mean position of color terms offered by two or more respondents in the elicitation task. (Rank orders are shown in brackets.)

Term	Gloss	Frequency		Mean position	
mhlophe	white	34	(2)	2.9	(3)
mnyama	black	34	(2)	2.4	(1)
bomvu	red	34	(2)	2.5	(2)
tyheli	yellow	31	(4)	3.7	(5.5)
hlaza	grue	30	(5)	3.4	(4)
mdaka	brown	21	(6)	4.3	(10.5)
pinki	pink	12	(7)	4.4	(12)
blue[a]	blue	11	(8)	3.7	(5.5)
purple[a]	purple	5	(9)	5.2	(13)
ngwevu	gray	4	(10.5)	4.0	(7.5)
bhelu	pale	4	(10.5)	4.3	(10.5)
grey[a]	gray	3	(12)	4.0	(7.5)
mthupi	egg yolk	2	(13)	4.2	(9)

[a]Our fieldworker and language consultant did not record the complete phonetic details for these terms.

Color Naming

The number of tiles named varied across subjects because they were allowed to respond that they did not know a name. On average respondents named 21.9 tiles, but women named significantly more tiles than men; the mean scores were 26.0 for women and 16.0 for men, $t = 2.5$, $df = 43$, $p < .02$.

Table 3 gives the most frequent term given to each tile, and the second most frequent term where there was one. It can be seen that there are many tiles that are named by only a few people; for example the regions that would be called orange (YO, OYO, O), purple (RVR through to BV), and pink (some of the tints [Ts] and shades [Ss] of ORO through to VRV) by an English speaker tend to elicit relatively few responses. The tiles that do elicit a response from the majority of respondents tend to be close to the universal foci of yellow (Y and YOY), red (RO, ROR and R), green (G, GYG and YG), black (Black and Gray 8), and white (White).

Table 3

Distribution of terms across the tiles in the naming task. For each tile we give its Color-Aid code, the most frequent term together with its frequency, and the second most frequent term, where there was one, and its frequency.

Color-Aid code	Term	Freq.	Code	Term	Freq.	Code	Term	Freq.
Y	tyheli	36	S2	hlaza	1			
				khaki	1			
YOY	tyheli	23	T4	tyheli	19	S2	grey	1
							khaki	1
YO	tyheli	9	T3	tyheli	15	S3	hlaza	1
	orange	1					khaki	1
OYO	bomvu	3						
	orange	3						
O	bomvu	7	S1	mdaka	15	S3	mdaka	24
	orange	4					coffee	1
ORO	bomvu	20	T3	pinki	4	S3	grey	5
	pinki	2						
RO	bomvu	29	T3	pinki	6	S3	mnyama	12
							mdaka	11
ROR	bomvu	19	T3	pinki	7	S3	pinki	4
							purple	1
R	bomvu	27	T4	pinki	10	S3	mnyama	11
							mdaka	8
RVR	bomvu	3	S1	pinki	2	S3	pinki	8
	pinki	3		purple	2			
RV	purple	6	T2	pinki	7			
	pinki	1						
VRV	purple	11	S3	pinki	9			
V	purple	9						
	navy	2						

(continued on next page)

Table 3—*Continued*

Color-Aid code	Term	Freq.	Code	Term	Freq.	Code	Term	Freq.
VBV	purple	5	T4	purple	4			
	navy	2						
BV	blue	5	S2	grey	5			
	navy	3		mnyama	1			
BVB	blue	15	S3	purple	2			
	navy	2		blue	1			
B	blue	15	T1	blue	17			
BGB	blue	13	T3	blue	21			
BG	blue	9	S2	blue	5	T1	blue	14
				hlaza	1		hlaza	2
GBG	hlaza	20	S2	hlaza	15			
				blue	1			
G	hlaza	27	S3	hlaza	7			
				mnyama	1			
GYG	hlaza	20	T4	hlaza	12	S1	grey	2
				blue	1			
	blue	1						
YG	hlaza	27	S3	mnyama	6			
				grey	3			
YGY	hlaza	19	S3	hlaza	3			
SIENNA	mdaka	18						
	bomvu	2						
ROSE	pinki	10						
	bomvu	2						
WHITE	mhlophe	44						
BLACK	mnyama	31						
	grey	1						
GRAY 8	mnyama	36	6	grey	13	4	grey	19
	blue	1		mnyama	4		mdaka	4

Table 4 gives the frequency with which each term was used, summed across respondents and tiles, in the same order as for Table 2. It can be seen that the rank order of these frequencies is similar to that in Table 2; the main exceptions are that *mhlophe* 'white' has a lower position than in Table 2, whereas *blue* 'blue' has a higher position.

As well as considering the frequency with which terms are used, it is important to consider their *dispersion*. There should be good agreement between speakers as to the referents of the basic terms, and this would be reflected by narrow concentrations of term use rather than a thinly spread distribution. In Table 4, we have attempted to give indices of the patterns of dispersion in two ways: *dominance* indices and *specificity* indices. We say

Table 4
Frequency of naming, dominance index (d), and specificity index (S.I.). The fractions next to the dominance indexes indicate the proportion of the sample that had to be exceeded for a term to be dominant according to that criterion.

Term	Gloss	Frequency and rank		d/¼	d/⅓	d/½	d/⅔	d/¾	S.I.
mhlophe	white	44	(8)	1	1	1 (5.5)	1	1	1
mnyama	black	107	(4)	4	2	2 (2.5)	2	1	0.63
bomvu	red	120	(2)	4	4	2 (2.5)	1	0	0.48
tyheli	yellow	104	(5)	4	4	2 (2.5)	1	1	0.57
hlaza	grue	144	(1)	6	5	2 (2.5)	0	0	0.38
mdaka	brown	82	(6)	3	2	1 (5.5)	0	0	0.29
pinki	pink	75	(7)	0	0	0 (8.5)	0	0	0
blue	blue	113	(3)	7	4	0 (8.5)	0	0	0
purple	purple	43	(10)	0	0	0 (8.5)	0	0	0
grey	grey	54	(9)	2	1	0 (8.5)	0	0	0
navy	navy	12	(11)						
orange	orange	9	(12)						
violet	violet	3	(13.5)						
khaki	khaki	3	(13.5)						
coffee	coffee	1	(15.5)						
fawn	fawn	1	(15.5)						

that a term is dominant, if it is the most frequent term used for a tile and the frequency of use for that tile exceeds a given proportion of the sample, the *threshold*. We give several dominance measures that vary only in how high the threshold is: the first dominance index requires at least a quarter of the sample to have used that term for a given tile, as well as it being the most frequent response; as we move to the right in the table, this threshold rises through one-third, a half, and two-thirds, to three-quarters. We give these multiple measures because the threshold taken is arbitrary and multiple measures provide a more complete picture. At the lowest threshold, eight terms have at least one *dominant tile;* these are: *mhlophe* 'white,' *mnyama* 'black,' *bomvu* 'red,' *tyheli* 'yellow,' *hlaza* 'grue,' *mdaka* 'brown,' *blue* 'blue,' and *grey* 'gray.' Increasing the threshold to one-third leads to *grey* 'gray' losing its dominant tile; increasing the threshold to one-half leads to the indexes for *blue* 'blue' dropping to zero; at a threshold of two-thirds *hlaza* 'grue' has an index of zero; and finally at the highest threshold *bomvu* 'red' drops to an index of zero.

The final column of Table 4 gives the specificity index: this is the ratio of the frequency of dominant use to total use. (We give this measure just for the dominance index with a threshold of a half.) For example, *bomvu* 'red' is dominant for two tiles (column six of Table 4): RO hue and R hue, as given in Table 3; its total frequency for these two tiles is 57, and its overall frequency is 120, as given in column three of Table 4. The ratio of these two frequencies is 0.48, as shown in the final column of Table 4. The specificity

index is partially independent of overall frequency; thus, although *mhlophe* 'white' has a relatively low total frequency, it has a high specificity index because its use is restricted to just one tile—it is used very specifically. In contrast, *hlaza* 'grue' and *blue* 'blue' both have high total frequencies but have low specificity indices, reflecting wide and thinly spread use. The six most frequent terms in the list task (Table 2) are the only terms to have nonzero specificity indices. The rank orders on the specificity index also match the Berlin and Kay hierarchy well; the only discrepancies are that the scores for *mnyama* 'black' and *mhlophe* 'white' are far from equal, and *bomvu* 'red' scores less than *tyheli* 'yellow.'

Combining the Measures

In trying to establish which terms are basic, or trying to estimate the degree of basicness of each term, it is possible that a combination of several measures may be more discriminating than any single measure. Here we consider three ways of combining the measures: *hurdles jumped*, the mean rank, and a *structural vector* combination (see Corbett and Davies, in press, for a discussion of measures of basicness, and Davies et al. 1992 for a similar analysis of the basic terms of Setswana).

Table 5 shows whether each term has exceeded the threshold of basicness: a "+" indicates that it has and a "-" that it has not. The final column gives the total number of hurdles jumped by each term. We say that a term has jumped a hurdle on a particular measure if its score on that measure suggests that it is a basic term. This model assumes an all or nothing concept of basicness: if a term exceeds a threshold on a measure, it is basic; otherwise

Table 5
Hurdles cleared. Summary of whether terms exceeded the criteria for basicness on each measure, and the total number of hurdles cleared. (A "+" indicates the threshold was exceeded; a "-" indicates failure at that hurdle. The thresholds for each measure are shown below the headings. Freq = frequency, M.P. = mean position, D.I. = dominance index, and S.I. = specificity index.)

Term	Gloss	List task		Naming task			Total Hurdles
		Freq >20	M.P. <4	Freq >100	D.I. (50%) ≥1	S.I. >0.4	
mhlophe	white	+	+	-	+	+	4
mnyama	black	+	+	+	+	+	5
bomvu	red	+	+	+	+	+	5
tyheli	yellow	+	+	+	+	+	5
hlaza	grue	+	+	+	+	-	4
mdaka	brown	+	-	-	+	-	1
pinki	pink	-	-	-	-	-	0
blue	blue	-	+	+	-	-	1
purple	purple	-	-	-	-	-	0
grey	grey	-	-	-	-	-	0

it is nonbasic. But in adding hurdles jumped, it admits a graded concept of basicness. There is a degree of arbitrariness about the height of the hurdle (the threshold) for each task: our selected thresholds are placed at the point where there seems to be a relatively sharp change—a step—between highest scoring set and the rest. The thresholds are: (1) list frequency (more than half the sample offered the term); (2) list position (a score of less than four); (3) frequency of naming (a score greater than 100); (4) dominance (at least one dominant tile); and (5) specificity (a score greater than 0.4). Five terms jump at least all but one hurdle: *mhlophe* 'white,' *mnyama* 'black,' *bomvu* 'red,' *tyheli* 'yellow,' and *hlaza* 'grue.' Of the remainder, two—*mdaka* 'brown' and *blue*—jump one hurdle, and the remainder fail all the hurdles.

The second basis for combining the measures is the mean rank. Table 6 shows the rank for each term on each measure, and the final column shows the mean rank for each term. The same terms that occupied the first five ranks on the hurdles model again occupy the first 5 ranks. But the step between these five and the next two—*mdaka* 'brown' and *pinki* 'pink'—is less sharp than in Table 5. This blurring of the boundary is mainly due to the relatively low score of *mhlophe* 'white,' which arises because, although it is used very specifically, it has a low score on the frequency of naming measure.

The final way of combining measures which we consider is a weighted combination derived from correspondence analysis (see Weller and Romney 1990). This procedure looks for structure underlying data matrices such as the term-by-measures matrix that we have here. The structure is represented as a number of vectors on which each element and each measure have scores. The structural vectors may be thought of as the axes of a "space" in which the elements—in this case the terms and measures—are positioned; the closer together terms or measures are to each other, the

Table 6
Rank orders, mean of the rank orders, and the rank of the mean for each term. (Freq = frequency, M.P. = mean position, D.I. = dominance index, and S.I. = specificity index.)

Term	Gloss	List task		Naming task			Mean	Rank of
		Freq	M.P.	Freq	D.I.	S.I.	Rank	Means
mhlophe	white	2	3	8	5.5	1	3.9	4.5
mnyama	black	2	1	4	2.5	2	2.3	1
bomvu	red	2	2	2	2.5	4	2.5	2
tyheli	yellow	4	5.5	5	2.5	3	3.9	4.5
hlaza	grue	5	4	1	2.5	5	3.6	3
mdaka	brown	6	8	6	5.5	6	6.3	6
pinki	pink	7	9	7	8.5	8.5	8.0	8
blue	blue	8	5.5	3	8.5	8.5	6.7	7
purple	purple	9	10	10	8.5	8.5	9.2	10
grey	gray	10	7	9	8.5	8.5	8.6	9

Table 7
Correspondence analysis of the most frequent terms

Term	Gloss	Vector score
mhlophe	white	58.0
mnyama	black	14.1
bomvu	red	8.7
tyheli	yellow	10.1
hlaza	grue	-3.5
mdaka	brown	0.8
pinki	pink	-18.4
blue	blue	-27.6
purple	purple	-31.3
grey	gray	-39.4

greater their overall similarity. The analysis also gives the proportion of inertia accounted for by each vector—a measure of its "strength"—and the statistical significance of each vector.

The scores for the ten terms that appeared in both Tables 2 and 4 (the first ten terms in Table 4) on five measures—list frequency, list position, naming frequency, dominance (.5), and specificity—were subjected to correspondence analysis. This analysis revealed just one major vector: this accounted for 81.4 percent of the inertia ($p < .00009$). The scores for the color terms on this vector are shown in Table 7.

It can be seen that the main contenders for the basic slots, on the basis of Tables 2 and 4—*mhlophe* 'white,' *mnyama* 'black,' *bomvu* 'red,' *tyheli* 'yellow,' *hlaza* 'grue,' and *mdaka* 'brown'—tend to have the highest scores. Table 8 shows the scores for the five measures on the major vector. This is done in order to try to establish the relative contributions of each measure to the vector. List frequency, dominance, and specificity have high scores, whereas list position and frequency of naming have low scores. This suggests that the major vector is primarily composed of the list frequency, dominance, and specificity measures.

Table 8
Correspondence analysis of the measures

Measure	Vector score
List frequency	44.0
List position	-29.3
Naming frequency	-10.5
Dominance (50%)	51.5
Specificity	98.6

Discussion

Our results indicate strongly that three traditional terms—*mhlophe* 'white,' *mnyama* 'black,' and *bomvu* 'red'—and one borrowed term—*tyheli* 'yellow'—are certainly basic. In addition, *hlaza* 'grue' is probably basic. The four terms that we say are definitely basic have generally high ranks on all measures and also have the highest ranks on our combined measures. The main departure from this claim is that *mhlophe* 'white' has a relatively low score on the frequency of naming measure. But this measure is clearly a function of two factors. The first is the way in which color space is sampled; so, for instance, Boynton and Olson (1987) report a low incidence of frequency of naming of *red*, which they attribute to the characteristics of their stimuli rather than the nonbasicness of red. The second factor is the unique status of the perception of white: all color perception is relative to the totality of other colors in the scene, but this is particularly so for white. The percept of whiteness is, to a degree, a function of relative reflectivity of surfaces in the scene: the most reflective surface will appear white, and in contrast, the next most reflective surface may appear gray. In the current context, this means that for our stimulus set it is likely that only the most reflective color will be labeled 'white,' even though, in the absence of that stimulus, the next most reflective gray would appear white. This contrast effect was brought to our attention by our work on Setswana. We added two light-gray tiles to the set of colors in order to reduce the perceptual distinctiveness of the white color; but this maneuver was ineffective since, due to the relativity of the perception of white, the additional colors appeared gray, even though on their own they would have looked white. Overall, we are confident that *mhlophe* 'white' is basic.

The status of *hlaza* 'grue' is less clear cut than the status of the four terms that we claim are definitely basic. Our data suggests that it is basic, but its status is less secure than the first four terms that we have given. This is of particular interest, in that, as a major traditional term, it was almost certainly more basic than any yellow term, but we may be observing, in cross-section, the decomposition of the composite category 'grue.' The focus of *hlaza* 'grue' is primarily in the green region, with the borrowed term *blue* dominating in the blue region, albeit not strongly enough to be accorded basic status. *Blue* is used relatively frequently to name colors, but there is relatively low consensus as to what the term denotes, as indicated by its low dominance and specificity scores. The other term contending for basic status is *mdaka* 'brown.' While we gloss this as brown, its origin is the noun for 'dirt.' But the fact that our informants were prepared to use it to describe our tiles is consistent with it becoming independent of its origins. Even so, it does not score highly enough on our measures to qualify for basic status yet, and our work on Setswana makes us cautious in predicting that it will become basic. Setswana has a variety of traditional terms, such as *selaole* 'purple,' that looked as though they were strong contenders to eventually fill the missing basic slots. But our study of children in Botswana (Davies et al., in press) showed that, rather than extending the use of traditional terms, terms borrowed from English were "procured" to fill the missing basic slots. We are interested to see, therefore, what will become of *mdaka* 'brown.'

If we accept that *mhlophe* 'white,' *mnyama* 'black,' *bomvu* 'red,' *tyheli* 'yellow,' and *hlaza* 'grue' are the basic color terms of Xhosa, then this accords strongly with Berlin and Kay's original theory. Our "strength of basicness" measures are not in perfect alignment with the hierarchy, but nevertheless, there is a clear ordinal separation between our five proposed basic terms and the rest.

Our data, then, support Berlin and Kay synchronically: the basic terms of Xhosa fit the theory. But perhaps more importantly, we may be witnessing the decomposition of a composite category, and the filling of vacant basic slots by borrowing from English, which will be a test of the diachronic predictions. The developments will be interesting to follow.

Notes

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1. The CIE chromaticity coordinates (*Y x y*) provide an internationally agreed standard way of specifying every possible color uniquely. One way of interpreting the coordinates is to think of *x* as the proportion of red light in a stimulus and *y* as the proportion of green light in the stimulus. Thus in Figure 2, greens lie toward the top left of the graph, reds lie toward the right of the graph, and blues lie toward the origin. Achromatic colors (white, black, and gray) lie in the center of the graph, and the greater the distance from the center of the graph, the greater the saturation of the represented color. The *Y* coordinate represents reflectance (brightness); thus in three dimensions, white, gray, and black would be separated on the *Y* dimension. We include the loci of the universal foci in Figure 2 to aid interpretation of the graph. These loci correspond to the best exemplars of Berlin and Kay's hypothesized eleven universal color categories.

2. In Tables 1 and 3 the Color-Aid codes on the extreme left denote HUES (thus Y = Y HUE), while the codes in the second column denote variants of the HUE (thus the first S2 = Y S2). The tiles from the GRAY scale are GRAY 8, GRAY 6, and GRAY 4, and appear in the bottom row of the table.

3. A fixed random order carries with it the risk that some unforeseen and distorting property be selected. Such a risk is less likely with a set of different random orders.

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