Basic Color Terms

Their Universality and Evolution

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INTRODUCTION

ETHNOSCIENCE studies, and studies of color vocabulary in particular, have firmly established that to understand the full range of meaning of a word in any language, each new language must be approached in its own terms, without *a priori* theories of semantic universals. H. C. Conklin (1955) has shown, for example, that Hanunóo "color" words in fact encode a great deal of non-colorimetric information. The essentially methodological point made in such studies has been frequently misinterpreted by anthropologists and linguists as an argument against the existence of semantic universals. The research reported here strongly indicates that semantic universals do exist in the domain of color vocabulary. Moreover, these universals appear to be related to the historical development of all languages in a way that can properly be termed evolutionary.

§ 1 THE DATA, HYPOTHESIS, AND GENERAL FINDINGS

The primary experimental data were collected by students and the authors from native-speaking informants in each of twenty languages from a number of unrelated language families. These materials were supplemented by comparative data from whatever writings we could find, bringing our present sample of languages to ninety-eight, representing a wide variety of major linguistic stocks.

The study was originally designed as an experimental test of the following, loosely stated, hypothesis. The prevailing doctrine of American linguists and anthropologists has, in this century, been that of extreme linguistic relativity. Briefly, the doctrine of extreme linguistic relativity holds that each language performs the coding of experience into sound in a unique manner. Hence, each language is semantically arbitrary relative to every other language. According to this view, the search for semantic universals is fruitless in principle. The doctrine is chiefly associated in America with the names of Edward Sapir and B. L. Whorf. Proponents of this view frequently offer as a paradigm example the alleged total semantic arbitrariness of the lexical coding of color.[1] We suspect that this allegation of total arbitrariness in the way languages segment the color space is a gross overstatement.

Our hypothesis was based on our intuitive experience in several languages of three unrelated major stocks. Our feeling was that color words translate too easily among various pairs of unrelated languages for the extreme linguistic relativity thesis to be valid. Our results support the hypothesis and cast doubt on the commonly held belief that each language segments the three-dimensional color continuum arbitrarily and independently of each other language.[2] It appears now that, although different languages encode in their vocabularies different *numbers* of basic color categories, a total universal inventory of exactly eleven basic color categories exists from which the eleven or fewer basic color terms of any given language are always drawn. The eleven basic color categories are *white, black, red, green, yellow, blue, brown, purple, pink, orange,* and *grey*.

A second and totally unexpected finding is the following. If a language encodes fewer than eleven basic color categories, then there are strict limitations on which categories it may encode. The distributional restrictions of color terms across languages are:

1. All languages contain terms for white and black.
2. If a language contains three terms, then it contains a term for red.
3. If a language contains four terms, then it contains a term for either green or yellow (but not both).
4. If a language contains five terms, then it contains terms for both green and yellow.

5. If a language contains six terms, then it contains a term for blue.
6. If a language contains seven terms, then it contains a term for brown.
7. If a language contains eight or more terms, then it contains a term for purple, pink, orange, grey, or some combination of these.

These distributional facts are summarized in Table I, in which each row corresponds to an actually occurring type of

TABLE I
THE TWENTY-TWO ACTUALLY OCCURRING TYPES OF BASIC COLOR LEXICON

Type	No. of basic color terms	Perceptual categories encoded in the basic color terms										
		white	black	red	green	yellow	blue	brown	pink	purple	orange	grey
1	2	+	+	−	−	−	−	−	−	−	−	−
2	3	+	+	+	−	−	−	−	−	−	−	−
3	4	+	+	+	+	−	−	−	−	−	−	−
4	4	+	+	+	−	+	−	−	−	−	−	−
5	5	+	+	+	+	+	−	−	−	−	−	−
6	6	+	+	+	+	+	+	−	−	−	−	−
7	7	+	+	+	+	+	+	+	−	−	−	−
8	8	+	+	+	+	+	+	+	+	−	−	−
9	8	+	+	+	+	+	+	+	−	+	−	−
10	8	+	+	+	+	+	+	+	−	−	+	−
11	8	+	+	+	+	+	+	+	−	−	−	+
12	9	+	+	+	+	+	+	+	+	+	−	−
13	9	+	+	+	+	+	+	+	+	−	+	−
14	9	+	+	+	+	+	+	+	+	−	−	+
15	9	+	+	+	+	+	+	+	−	+	+	−
16	9	+	+	+	+	+	+	+	−	+	−	+
17	9	+	+	+	+	+	+	+	−	−	+	+
18	10	+	+	+	+	+	+	+	+	+	+	−
19	10	+	+	+	+	+	+	+	+	+	−	+
20	10	+	+	+	+	+	+	+	+	−	+	+
21	10	+	+	+	+	+	+	+	−	+	+	+
22	11	+	+	+	+	+	+	+	+	+	+	+

NOTE: Only these twenty-two out of the logically possible 2,048 combinations of the eleven basic color categories are found.

basic color lexicon. The pattern displayed by the actual distribution is a tight one; of the 2,048 (that is, 2^{11}) possible combinations of the eleven basic color terms, just twenty-two, about 1 per cent, are found to occur in fact.

Moreover, the twenty-two types which do occur are not unrelated but may be summarized by (or generated from) a rather simple rule:

$$(1)\quad \begin{bmatrix}\text{white}\\ \text{black}\end{bmatrix} < [\text{red}] < \begin{bmatrix}\text{green}\\ \text{yellow}\end{bmatrix} < [\text{blue}] < [\text{brown}] < \begin{bmatrix}\text{purple}\\ \text{pink}\\ \text{orange}\\ \text{grey}\end{bmatrix}$$

where, for distinct color categories (a, b), the expression $a < b$ signifies that a is present in every language in which b is present and also in some language in which b is not present. Rule (1) is thus a partial order on the set of basic color categories, the six bracketed sets being a series of six equivalence classes of this order.

It is argued in § 2 that rule (1) represents not only a distributional statement for contemporary languages but also the chronological order of the lexical encoding of basic color categories in each language. The chronological order is in turn interpreted as a sequence of evolutionary stages.

In §§ 2 and 3, additional data are adduced which show that the six equivalence classes of (1) correspond to seven temporal-evolutionary stages. In particular, the class [green, yellow] corresponds to the third and fourth stages rather than to a single stage as might be surmised from the data presented so far. The logical, partial ordering of rule (1) thus corresponds, according to our hypothesis, to a temporal-evolutionary ordering, as follows:

$$(2)\quad \begin{bmatrix}\text{white}\\ \text{black}\end{bmatrix} \rightarrow [\text{red}] \begin{array}{c}\nearrow [\text{green}] \rightarrow [\text{yellow}] \searrow\\ \searrow [\text{yellow}] \rightarrow [\text{green}] \nearrow\end{array} [\text{blue}] \rightarrow [\text{brown}] \rightarrow \begin{bmatrix}\text{purple}\\ \text{pink}\\ \text{orange}\\ \text{grey}\end{bmatrix}$$

where the meaning of the arrow will be discussed in § 2.

In sum, our two major findings indicate that the referents for the basic color terms of all languages appear to be drawn from

a set of eleven universal perceptual categories, and these categories become encoded in the history of a given language in a partially fixed order. There appears to be no evidence to indicate that differences in complexity of basic color lexicons between one language and another reflect perceptual differences between the speakers of those languages.

§ *1.1 Procedure*

Standardized color stimuli were used in conducting the research. These consist of a set of 329 color chips provided by the Munsell Color Company. The set is composed of 320 color chips of forty equally spaced hues and eight degrees of brightness, all at maximum saturation, and nine chips of neutral hue (white, black and greys). The full set of chips was mounted on stiff cardboard and covered with clear acetate to form the array shown in Figure 1. With the exception of our addition of the neutral hue series, these materials are the same as those used by Lenneberg and Roberts (1956) in their classic cross-cultural study of English and Zuni color terminology.[3] Our method of eliciting basic color terms and obtaining the individual mappings differs, however, from theirs, as may be seen by comparing the following discussion with their work (see § 3.7).

The data were gathered in two stages. First, the basic color words of the language in question were elicited from the informant, using as little as possible of any other language.[4] Secondly, each subject was instructed to map both the focal point and the outer boundary of each of his basic color terms on the array of standard color stimuli described above.

§ *1.2 Defining the concept of basic color term*

Every language has an indefinitely large number of expressions that denote the sensation of color. Note, for example, the following English expressions: (a) *crimson,* (b) *scarlet,* (c) *blond,* (d) *blue-green,* (e) *bluish,* (f) *lemon-colored,* (g) *salmon-colored,* (h) *the color of the rust on my aunt's old Chevrolet.* But psychologists, linguists, and anthropologists have long operated with a concept of basic color term, or basic color word, which excludes forms such as (a) – (h) and includes forms like *black, white, red,* and *green.* However, the expression basic color term does not have a unique operational definition. We used the following procedure for the determination of basic color terms. Ideally, each basic color term should exhibit the following four characteristics:

(i) It is *monolexemic;* that is, its meaning is not predictable from the meaning of its parts (cf. Conklin 1962). This criterion eliminates examples (e) – (h) and perhaps also (d).

(ii) Its signification is not included in that of any other color term. This criterion eliminates examples (a) and (b), which are both kinds of red for most speakers of English.

(iii) Its application must not be restricted to a narrow class of objects. This criterion eliminates example (c) which may be predicated only of hair, complexion, and furniture.

(iv) It must be psychologically salient for informants. Indices of psychological salience include, among others, (1) a tendency to occur at the beginning of elicited lists of color terms, (2) stability of reference across informants and across occasions of use, and (3) occurrence in the ideolects of all informants. This criterion eliminates all the examples (a) – (h), most particularly (h).

These criteria (i–iv) suffice in nearly all cases to determine the basic color terms in a given language. The few doubtful cases that arise are handled by the following subsidiary criteria:

(v) The doubtful form should have the same distributional potential as the previously established basic terms. For example, in English, allowing the suffix *-ish,* for example, *reddish, whitish,* and *greenish* are English words, but **aguaish* and **chartreus* (*e*) *ish* are not.

(vi) Color terms that are also the name of an object characteristically having that color are suspect, for example, *gold, silver,* and *ash.* This subsidiary criterion would exclude *orange,* in English, *if* it were a doubtful case on the basic criteria (i–iv).

(vii) Recent foreign loan words may be suspect.

(viii) In cases where lexemic status is difficult to assess [see criterion (1)], morphological complexity is given some weight as a secondary criterion. The English term *blue-green* might be eliminated by this criterion.

§ *1.3 Mapping basic color terms*

No informant was asked to map his color terms until the investigator had elicited verbally his full list of basic color terms. Then the stimulus board was covered with an acetate overlay and the informant was given a black grease pencil and asked to indicate for each basic color term, *x:*

(1) all those chips which he would under any conditions call *x.*

(2) the best, most typical examples of *x.*

Each informant was asked to perform the mapping procedure at least three times, at one-week intervals.

Our queries were designed to discover the total area of a basic category and to determine, as well, its focus or most typical members. Often we had access to only one informant for a language. However, in the case of Tzeltal, a Mayan language of southern Mexico, we were able to consult forty informants.

The languages studied were genetically diverse. The choice of each, however, was limited by the availability of informants. All informants were native speakers of their respective languages and, with the exception of the Tzeltal individuals, resided in the San Francisco Bay Area. The primary data include basic color terminologies for the following languages: Arabic (Lebanon), Bulgarian (Bulgaria), Catalan (Spain), Cantonese (China), Mandarin (China), English (United States), Hebrew (Israel), Hungarian (Hungary), Ibibio (Nigeria), Indonesian (Indonesia), Japanese (Japan), Korean (Korea), Pomo (California), Spanish (Mexico), Swahili (East Africa), Tagalog (Philippines), Thai (Thailand), Tzeltal (Southern Mexico), Urdu (India), and Vietnamese (Vietnam).

§ *1.4 Universality of basic color terms*

After all languages were mapped, we made a composite of the foci of all the basic color terms for all the languages. The composite is given in Figure 2; letters indicate the twenty languages

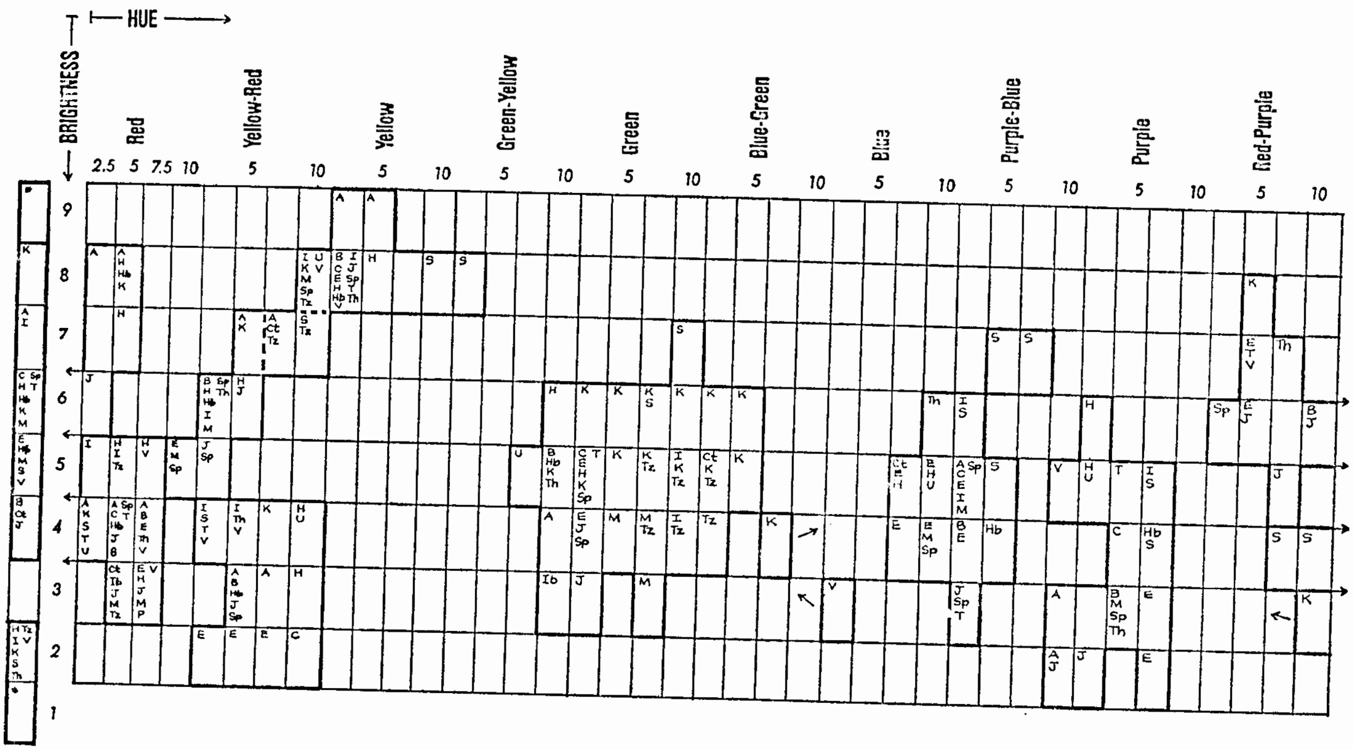

FIGURE 2. COMPOSITE OF FOCI OF BASIC COLOR TERMS IN TWENTY LANGUAGES. NOTE: Dotted lines indicate an overlap of orange and yellow focal areas. These chips represent yellow for Tzeltal and Cantonese, and orange for Arabic and Swahili. * indicates chips chosen as category foci for all twenty languages. Arrows indicate affiliations of categories for the languages indicated. Where a letter occurs more than once on adjacent chips, each was judged a good representative of the focus of the category.

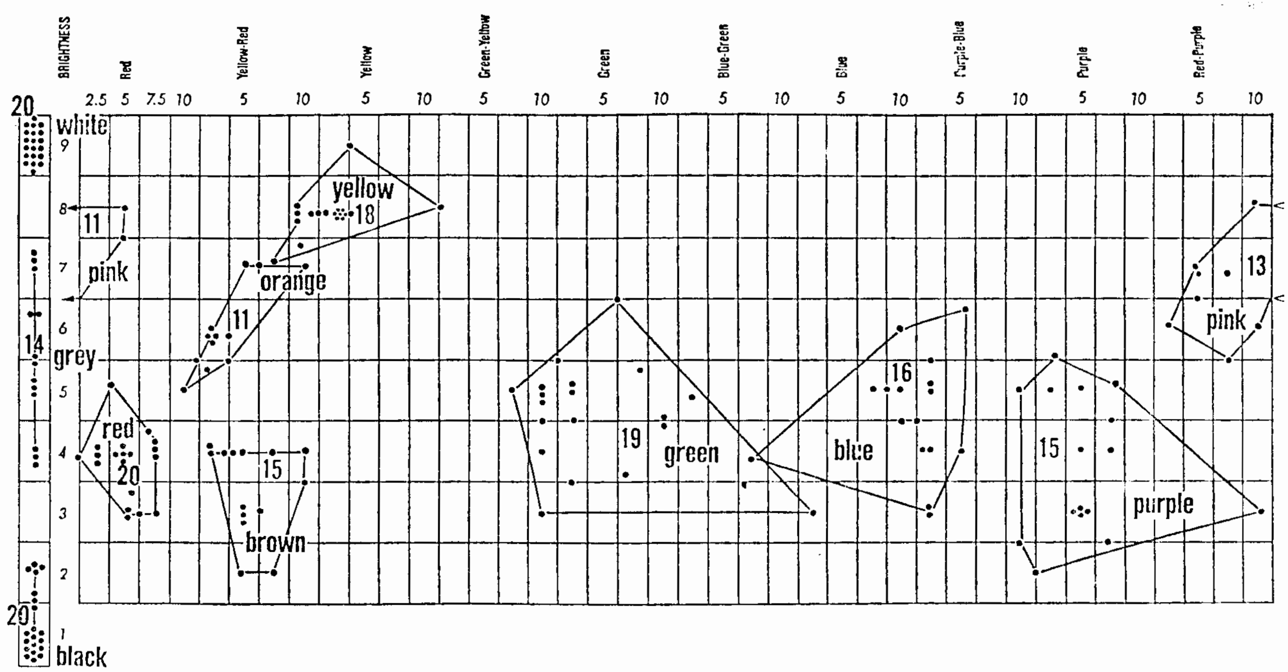

FIGURE 3. NORMALIZED FOCI OF BASIC COLOR TERMS IN TWENTY LANGUAGES. NOTE: Numerals appearing along the borders of the chart refer to the Munsell system of color notation. Numerals appearing on the body of the chart refer to the number of languages in the sample of twenty which encode the corresponding color category. The smallest possible number of lines are used to enclose each color area.

for which we have experimentally collected data. Where several neighboring chips are marked by the same letter, each was judged to be an equally good representative of the focus of a category. Figure 2, although a brute summary of the data and consequently hard to read, nevertheless shows the considerable extent to which the foci of color categories are similar among totally unrelated languages. Both the large blank areas (over 70 per cent of the surface of the chart) and the close clustering of the foci of the various languages into discrete, contiguous areas attest to the failure of the strict linguistic relativity hypothesis. The individual terms and the mapping for each of the twenty languages are given in Appendix I.

The failure of the traditional hypothesis can be seen more clearly in Figure 3. As shown in Figure 2, our informants frequently designated more than one chip as the focus of a color term. Figure 3 is based on a calculation of the center of gravity of the focus area for each basic color term in each language. In each of the eleven areas the number of languages for which the foci are included is indicated by a numeral, and an associated gloss (for example, 'white', 'red') is given. The results shown in Figure 3 support our initial hypothesis: *color categorization is not random and the foci of basic color terms are similar in all languages.*

§ *1.5 Inter-language versus inter-informant variability*

Further evidence for the cross-language universality of color foci is that the location of color foci varies no more between speakers of different languages than between speakers of the same language. In fact, in our tests, speakers of the same language show slightly more variability among themselves than speakers of different languages do. The hypothesis of significant difference *between* languages must consequently be rejected regardless of sampling assumptions, although the small absolute difference in the opposite direction is doubtless insignificant.

The only language for which we have reliable data for a substantial number of informants is Tzeltal; Berlin gathered data from forty Tzeltal informants. Of these, thirty-one located the center of *yaš* in the green area and nine in the blue area; this fact is discussed in detail in § 2.3.4. Tzeltal has five basic color terms: 'white', 'black', 'red', 'green' (that is, *yaš*), and 'yellow'. For the purpose of intralanguage comparison, a random sample of ten informants was selected from among the thirty-one *yaš*-normals.[5]

There are no other languages in our basic sample containing just five terms. However, three languages, Japanese, Korean, and Cantonese, can be reconstructed to five-term systems on the basis of internal evidence (see § 2.4 for detailed discussion of internal linguistic reconstruction of basic color terms). The data for Cantonese, Korean, and Japanese were obtained from a single informant for each language. The foci for 'white', 'black', 'red', 'green', and 'yellow' in these three languages and in Tzeltal were used for the inter-language comparisons.[6]

In order to introduce a finer co-ordinate system for computing inter-focus distances, each unit of hue and each unit of brightness was subdivided into four units, yielding 160 units of hue and thirty-two of brightness. That is, each box in Figure 1 is considered a square of 4-unit side rather than 1-unit side. Each of the ten Tzeltal informants was compared to every other informant, yielding forty-five pairs. For each of the forty-five pairs, the straight-line distance between their foci for each of the five color categories was calculated, resulting in 225 distances (45 informant-pairs × 5 color categories). The overall mean of these 225 inter-informant, intra-language, differences is 4.47 units on the fine scale, or roughly one and one-eighth chip widths.

Then the distances between foci were calculated for each pair of languages for each of the five categories. Two sets of foci were used for Tzeltal in these comparisons: (1) the five foci of a single informant selected at random from the sample of ten, and (2) the five mean foci for the ten informants. The different methods of treating Tzeltal did not affect the result.

Finally, for each pair of languages, the distances for each of the five foci were averaged to determine a single mean distance for every combination of two languages. The results of these

TABLE II

COMPARISON OF MEAN DISTANCES IN THE LOCATION OF FIVE COLOR FOCI AMONG FOUR LANGUAGES AND AMONG TEN SPEAKERS OF ONE LANGUAGE

I	Mean inter-focus difference for ten Tzeltal (*yaš*-normal) informants	4.47
II	Mean inter-focus difference for all pairs of four languages	
	1. Japanese-Cantonese	4.43
	2. Japanese-Korean	4.30
	3. Cantonese-Korean	4.18
	4. Japanese-Tzeltal	
	(i) one Tzeltal informant	3.84
	[(ii) mean focus for ten Tzeltal informants	3.00]
	5. Cantonese-Tzeltal	
	(i) one Tzeltal informant	2.74
	[(ii) mean focus for ten Tzeltal informants	3.72]
	6. Korean-Tzeltal	
	(i) one Tzeltal informant	2.30
	[(ii) mean focus for ten Tzeltal informants	3.18]

NOTE: The mean absolute inter-informant (intra-language) distance exceeds each absolute inter-language difference. We must consequently reject any hypothesis of significantly greater inter-language than intra-language difference in favor of a null hypothesis of no such difference. In short, controlling for the number of terms, two informants speaking the same language are, on the average, no more similar than two informants speaking different languages.

computations are summarized in Table II, which shows that every inter-language distance is exceeded by the mean inter-informant distance for the sample of Tzeltal informants.

These results controvert the traditional relativistic hypothesis concerning the nature of human color categorization. While it can be argued that bilingualism in English affects the results to some extent (cf. Ervin, 1961), we find it hard to believe that English could so consistently influence the placement of the foci in these diverse languages. Moreover, the work completed with forty Tzeltal informants, who varied from Tzeltal monolinguals to Tzeltal-Spanish bilinguals, indicates that our results are not skewed as a result of bilingualism. Finally, the fact that inter-individual differences in a given language are as great as inter-language differences considerably weakens the possible objection that the bilingualism of the informants consulted distorted our findings.

§ 1.6 *Category foci versus category boundaries*

Repeated mapping trials with the same informant and also across informants showed that category foci placements are highly reliable. It is rare that a category focus is displaced by more than two adjacent chips. Category boundaries, however, are not reliable, even for repeated trials with the same informant. This is reflected in the ease with which informants designated foci, in contrast with their difficulty in placing boundaries. Subjects hesitated for long periods before performing the latter task, demanded clarification of the instructions, and otherwise indicated that this task is more difficult than assigning foci. In fact, in marked contrast to the foci, category boundaries proved to be so unreliable, even for an individual informant, that they have been accorded a relatively minor place in the analysis. Consequently, whenever we speak of color categories, *we refer to the foci of categories, rather than to their boundaries or total area,* except when specifically stating otherwise.

Two alternative interpretations of this result suggest themselves. First, it is possible that the brain's primary storage procedure for the physical reference of color categories is concerned with points (or very small volumes) of the color solid rather than extended volumes. Secondary processes, of lower salience and intersubjective homogeneity, would then account for the extensions of reference to points in the color solid not equivalent to (or included in) the focus. Current formal theories of lexical definition are not able to deal naturally with such phenomena. If empirical results of this kind accumulate, simple Boolean function theories of lexical definition will have to be revised in favor of more powerful formalisms.[7] We do not pursue this matter here, especially since there is reason to suspect that color, and perhaps a few other semantic domains such as smell, taste, and noise, have unusual lexical properties.

The alternative explanation is that this is a peculiarity of our experimental procedure. In retrospect, we find nothing which would be likely to produce such a bias. Moreover, the evolutionary scheme, including the data from the additional languages ordered by it, works so well in terms of foci that it argues against interpreting the apparent reality of foci as an artifact of the method.

§ 2 EVOLUTION OF BASIC COLOR TERMS

Our second major conclusion is that there appears to be a fixed sequence of evolutionary stages through which a language must pass as its basic color vocabulary increases.

This conclusion is based in part on the substantiation of the universality of the eleven basic category foci, in part on the non-randomness of their distribution across contemporary languages (and certain logical consequences of the particular distribution found), and in part on additional data and arguments to be introduced below.

An important methodological consequence of the universality finding is that we have been able to expand our data base from the twenty languages treated experimentally to a larger number, reported with varying degrees of precision in the general literature. Once the basic universal category foci are established, meaningful comparison can often be made with literary accounts of color nomenclatures.[8] It may be that the traditional relativistic position has derived in part from a confusion of noncomparability of *descriptions* of systems with random variation of structure among the systems themselves.

As shown in rule (1), the basic color categories are partially ordered in six equivalence classes, so that if a language encodes a category from a given class, it must encode all categories from each prior class. This empirical generalization holds, not only for the original twenty languages investigated, but for all languages in our sample (with the minor exceptions discussed in § 2.5). There is no reason to suppose that this generalization, which applies so clearly in the present, should not apply also in the past; at least, we know of no result from historical linguistics—or any other discipline—which would impel such an otherwise unmotivated complication of assumptions. Accepting then, that rule (1) applies also to prior stages of individual languages, it follows that for a language to gain or lose color

terms it must do so in the order specified by rule (1). Although it is logically as possible for languages to lose basic color terms as to gain them over time, this appears rarely, if ever, to actually happen. In our consideration of ninety-eight languages, which involved the assessment of comparative and internal historical evidence, we have so far found no indication of the loss of a basic color term.[9]

Hence, the six equivalence classes of rule (1) may be interpreted as representing at least six evolutionary stages of complexity of basic color lexicon, which have the following properties: that a given language at a given point of time can be assigned to one and only one stage; and that a language currently in a given stage must historically have passed through all prior stages in the appropriate order.

We say "at least" six evolutionary stages because, in fact, the data lead us to posit seven stages. In particular, as suggested in the discussion of rule (1) in § 1, the emergence of green and yellow each signals a separate stage of development, despite the fact that yellow occasionally appears before green. That is, we consider Stage III to be signalled by the appearance of either green or yellow and Stage IV to be signalled by the appearance of whichever of the two did not appear at Stage III.

Our data contain too many four-term systems to allow us to postulate the simultaneous occurrence of the fourth and fifth terms. If we contrast the first and last equivalence classes of rule (1), we find a different situation. In the case of {black, white}, we find no instance of a language possessing one term and not the other; that is, there are no one-term systems. Similarly, for {purple, pink, orange, grey}, there is a strong tendency for a language which possesses one of these terms to possess all of them. Of the twenty Stage VII systems we have found, nine or 45 per cent, contain all eleven terms, hence all members of the class {purple, pink, orange, grey}. Furthermore, the list of eleven-term systems could be expanded considerably by adding all the Indo-European languages of Europe, bringing the above noted proportion to at least 70 per cent. On the other hand, while our data show eighteen Stage IV systems (those containing terms for both green and yellow), they also show seventeen systems with terms for either green or yellow but not both.

These facts argue against the simultaneous appearance of green and yellow.

§ 2.1 *Basic color lexicon and technological/cultural complexity*

In addition to the fact that the stages of complexity of color vocabulary have a temporal ordering, there appears to be a positive correlation between general cultural complexity (and/or level of technological development) and complexity of color vocabulary. All the languages of highly industrialized European and Asian peoples are Stage VII, while all representatives of early Stages (I, II, and III) are spoken by peoples with small populations and limited technology, located in isolated areas. However, this kind of correlation cannot be established with precision until concepts such as "level of technological development" and "degree of cultural complexity" are better understood and more precisely measured than they are at present. Such information as we have, although vague, suggests that the sequence of elaboration of color lexicon is an evolutionary one accompanying, and perhaps a reflex of, increasing technological and cultural advancement.

The total vocabularies of languages spoken by peoples possessing relatively simple technologies tend to be smaller than those of highly complex civilizations. Moreover, it seems likely that the earliest languages spoken by man had extremely small vocabularies, perhaps not many times greater than the repertoires of discreet verbal signs used by apes and monkeys.[10] Thus, increase in the number of basic color terms may be seen as part of a general increase in vocabulary, a response to an informationally richer cultural environment about which speakers must communicate effectively. There is also some evidence to suggest that for groups living "close to nature," basic color terms are of relatively little adaptive value because of their broadness of reference (Post, 1962). For example, to a group whose members have frequent occasion to contrast fine shades of leaf color and who possess no dyed fabrics, color-coded electrical wires, and so forth, it may not be worthwhile to rote-learn labels for gross perceptual discriminations such as green/blue, despite the psychophysical salience of such contrasts.[11]

The above argument is not offered as conclusive but as a

plausible speculation about the cultural evolutionary mechanisms which account for the growth in size of basic color lexicon. In any case, the argument is addressed only to the problem of increase in size of color vocabulary and does not attempt to explain the particular order in which color foci universally become encoded in individual lexicons. The latter topic is a difficult problem which is only vaguely understood at this time. We will return briefly to this point in § 4.

§ 2.2 *The seven stages in the evolution of basic color terms*

Stage I in the evolution of lexical color categories is represented by just two terms: *black* plus most dark hues, and *white* plus most light hues. For convenience we will write these categories BLACK and WHITE. Stage I is represented in Figure 4.[12]

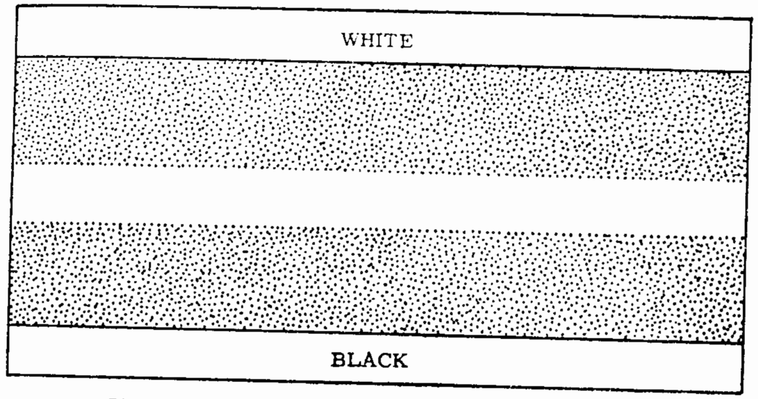

FIGURE 4. TYPICAL STAGE I BASIC COLOR LEXICON

At Stage II a third category emerges which we call RED. RED includes all reds, oranges, most yellows, browns, pinks, and purples (including violet). WHITE and BLACK continue to segment the middle-range hues. Stage II is represented in Figure 5.

At Stage III the reduction in scope of WHITE and BLACK continues and a new category emerges. This may be either GREEN or YELLOW. GREEN normally includes English yellow-green, greens, blue-greens, blues, and blue-purples; it may, however, include only greens plus yellow-greens and tans or light browns (as in Hanunóo, § 2.3.3). We designate the addi-

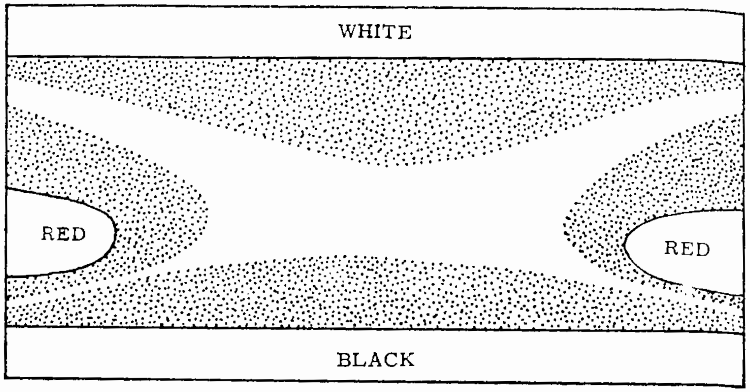

FIGURE 5. TYPICAL STAGE II BASIC COLOR LEXICON

tion of the GREEN category at Stage III as Stage IIIa. If the YELLOW category is added at Stage III the extension is always into light greens and light browns or tans. This development is designated Stage IIIb. Stages IIIa and IIIb are depicted in figures 6A and 6B respectively.

At Stage IV YELLOW or GREEN, whichever did not emerge at the previous stage, now emerges. The GREEN term now includes most blues, irrespective of the variant of Stage III through which the language has passed. RED continues to encompass the areas of English red, some yellow-reds, purple, and purple-reds.

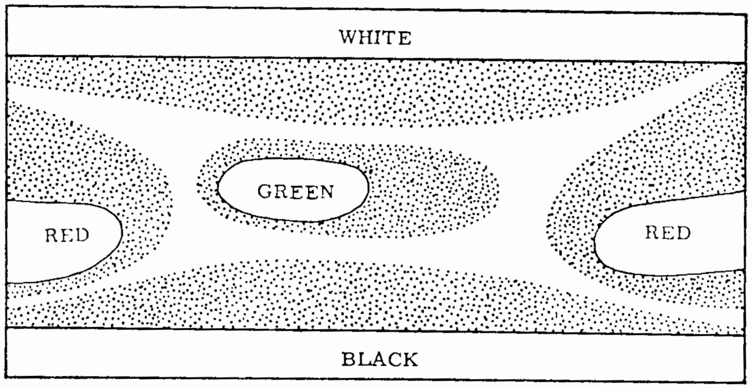

FIGURE 6A. TYPICAL STAGE IIIa BASIC COLOR LEXICON

GREEN *extended into blues. In Hanunóo,* GREEN *includes greens, yellow greens, tans & browns.*

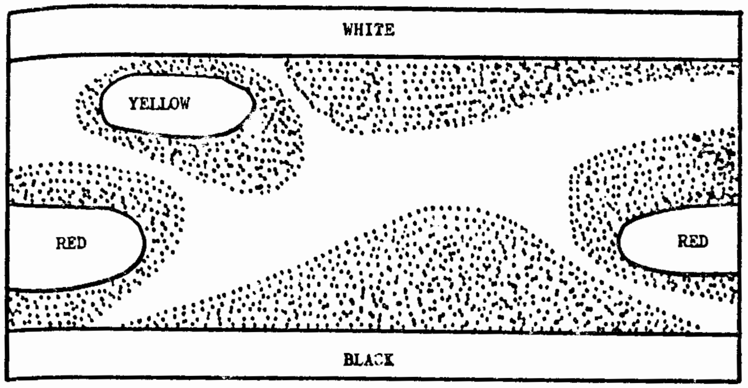

FIGURE 6B. TYPICAL STAGE IIIb BASIC COLOR LEXICON

YELLOW *extended into greens*

Presumably, BLACK and WHITE continue to be deprived of hue reference, becoming increasingly restricted to neutral values. Stage IV is shown in Figure 7.

At Stage V the focus of blue emerges from the GREEN area. GREEN now becomes green. At this stage, BLACK and WHITE are fully reduced to black and white, that is, to neutral values. The RED area is probably also reduced, losing purples and violets. Stage V is depicted in Figure 8.

Stage VI, the last at which a single focus appears, introduces brown. At Stage VI both RED and YELLOW become even more

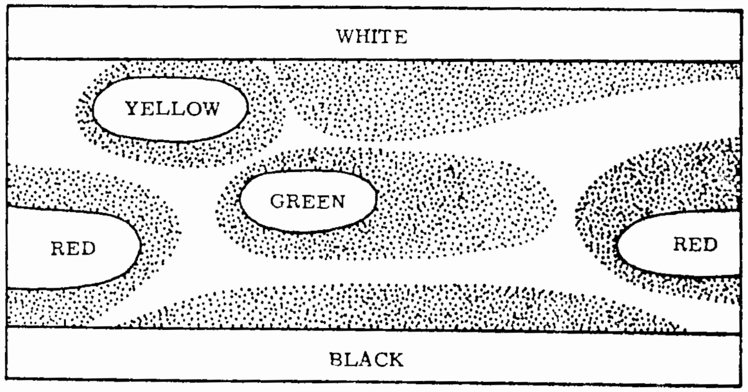

FIGURE 7. TYPICAL STAGE IV BASIC COLOR LEXICON

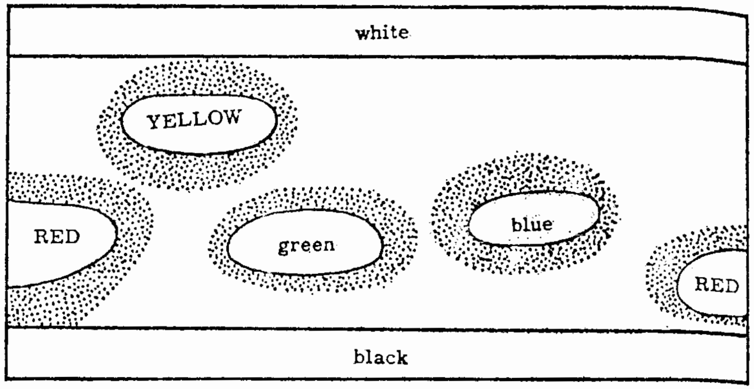

FIGURE 8. TYPICAL STAGE V BASIC COLOR LEXICON

restricted in scope although it is not until Stage VII that they become red and yellow. Stage VI is seen in Figure 9.

When the color lexicon expands beyond seven terms, that is, beyond Stage VI, there is a rapid expansion to the full roster of eleven basic color categories. This conclusion is suggested by the fact that, for the ninety-eight languages investigated, only eleven color lexicons belong to types other than 1, 2, 3, 4, 5, 6, 7 and 22 (see Table III). Apparently, at Stage VII, the remaining basic categories, purple, pink, orange, and grey, are quickly added to the lexicon and, as far as we have been

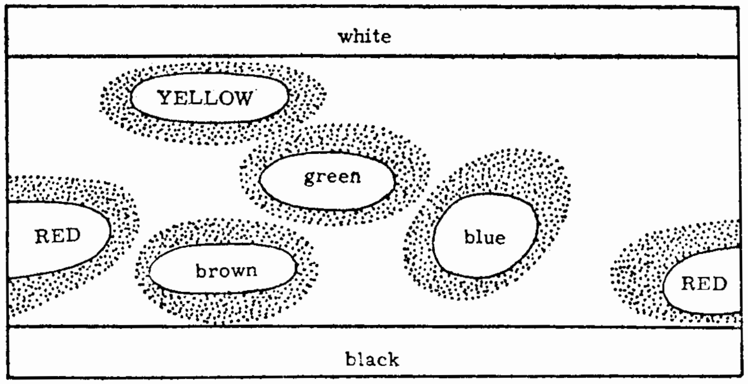

FIGURE 9. TYPICAL STAGE VI BASIC COLOR LEXICON

TABLE III

DISTRIBUTION OF NINETY-EIGHT BASIC COLOR LEXICONS AMONG THE TWENTY-TWO THEORETICALLY POSSIBLE TYPES, WITH INDICATION OF EVOLUTIONARY STAGE

Type	No. of Basic Color Terms	Stage	No. of Examples	
1	2	I	9	9
2	3	II	21	21
3	4	IIIa	8	
4	4	IIIb	9	17
5	5	IV	18 [a]	18
6	6	V	8 [b]	8
7	7	VI	5	5
8	8	VII	1	
9	8	VII	0	
10	8	VII	0	
11	8	VII	1	
12	9	VII	0	
13	9	VII	0	
14	9	VII	1	
15	9	VII	0	
16	9	VII	1 [c]	
17	9	VII	0	
18	10	VII	1	
19	10	VII	3 [d]	
20	10	VII	3	
21	10	VII	0	
22	11	VII	9 [e]	20
			Total 98	98

KEY TO TABLE III. a. Western Apache, Hopi and Papago are Stage IV systems, but have six terms. See §§ 2.5 and 3.4.
b. Samal is a Stage V system, but may have seven terms. See §§ 2.5 and 3.5.
c. Cantonese has only eight terms. See §§ 2.5 and 3.7.
d. Vietnamese has only nine terms. See §§ 2.5 and 3.7.
e. Hungarian and Russian have twelve terms each. See §§ 2.3.7 and 3.7.

able to ascertain, in no particular order. Our data suggest that purple and pink probably arise from RED although occasionally purple may come from BLACK. Orange usually becomes isolated from YELLOW but there is some evidence to indicate that in some cases it may have arisen from RED. Grey represents simply the encoding of mid-brightness neutral hues between black and white.

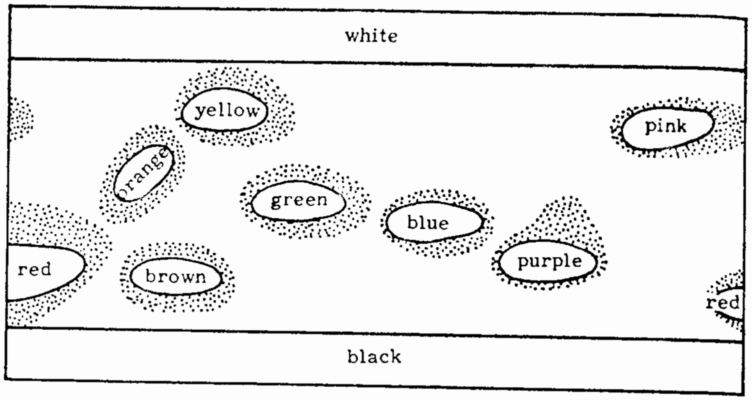

FIGURE 10. TYPICAL STAGE VII BASIC COLOR LEXICON, ELEVEN-TERM SYSTEM *

Stage VII systems include all eight-, nine-, ten-, and eleven-term systems; they thus include types 8–22. As shown in Table III, of the twenty Stage VII systems so far encountered, nine are of type 22, that is, they contain all eleven basic categories, while seven of the fifteen possible types of Stage VII are not represented at all (cf. note 5, also § 2.3). An eleven-term Stage VII system is seen in Figure 10.

To summarize to this point, at least seven stages may be recognized in the evolution of basic color terms. These stages and their basic color terms are as follows:

Stage I BLACK, WHITE (two terms)
Stage II BLACK, WHITE, RED (three terms)

* The eleventh category, grey, cannot be depicted on the above diagram given the conventions discussed in Note 12.

Stage IIIa BLACK, WHITE, RED, GREEN (extending into blues) (four terms)
Stage IIIb BLACK, WHITE, RED, YELLOW (four terms)
Stage IV BLACK, WHITE, RED, GREEN, YELLOW (five terms)
Stage V black, white, RED, green, YELLOW, blue (six terms)
Stage VI black, white, RED, green, YELLOW, blue, brown (seven terms)
Stage VII black, white, red, green, yellow, blue, brown, purple, pink, orange, grey (eight, nine, ten, or eleven terms)

§ 2.3 *Some typical systems*

Our search of the literature for reports on color terminologies is admittedly incomplete. Nonetheless, we have gathered reasonably reliable information on seventy-eight languages in addition to the twenty languages for which we have experimental data. The results from all reliably reported languages are considered in §§ 3.1–3.7. They conform almost totally to our proposed evolutionary sequence. In the following subsections (2.3.1–2.3.7) we give several examples of each stage, with emphasis on the earlier, more interesting stages.

§ 2.3.1 *Stage I systems* [BLACK, WHITE]

Originally, we did not expect to discover an extant example of Stage I. We were thus pleasantly surprised to receive from K.-F. Koch the following report on the Jalé, a New Guinea Highland group, whose language has tentatively been classified as Danian (non-Austronesian). In a report made in our seminar, Koch, who was unaware of our findings, stoutly resisted suggestions that Jalé might have more than two true color terms. Jalé is Stage I, having basic color terms only for 'BLACK' and 'WHITE' (see Figure 11). There are other terms which, in highly specialized contexts, refer to certain hues; however, these terms are restricted almost exclusively to particular substances or objects, for example, *mut* 'red soil', and *pianó* 'name of plant whose leaves are used to rub yarn, dying it a green color'. Koch reports that when he referred to a 'green' object with *pianó,* he was consistently misunderstood. He subse-

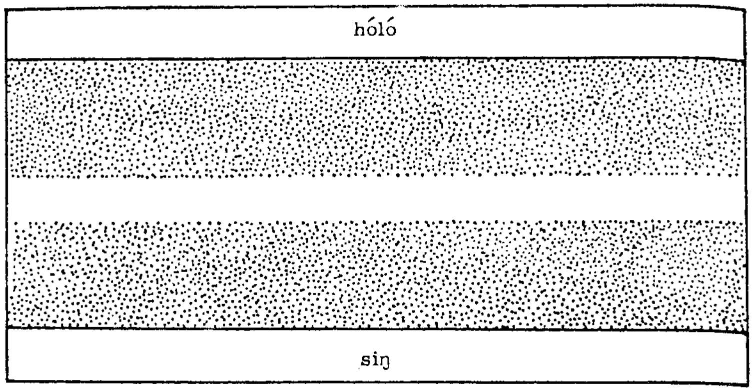

FIGURE 11. INFERRED COLOR CATEGORIES FOR JALÉ, REPRESENTING STAGE I

quently learned to use the term *siŋ* 'BLACK' or *hóló* 'WHITE', depending on the degree of brightness the particular green represented. That Jalé is in fact a Stage I system was made even more obvious when he reported that the appearance of blood is *siŋ* 'BLACK', exactly as 'blood (red)' should be at Stage I because of its low brightness.

Additional evidence of Stage I systems in Highland New Guinea has recently been presented by Bromley (1967), who also worked with Danian languages of the Grand Valley. Of the seven tribal groups for which Bromley published the native forms, three may be interpreted as exhibiting Stage I color terminology. Three of the remaining languages are probably Stage II systems, that is, they have added a term for RED, and one language is ambiguous in classification.

Bromley's comments on the problems presented by the basic color vocabulary of these groups are of particular interest. "In much of the area under study there are overlapping color taxonomies, one dividing all colors into two categories, 'brilliant', including most reds, yellow and white, and 'dull', including most greens and black. In various parts of the area 'white' and 'red' are also labelled by other simple terms, and an informant may either respond with one of the two general terms or one of the narrower special terms [that is, secondary terms]. Widely varying descriptive phrases are used for other specific color

terms; recurring examples are 'fresh leaf' for 'green' and 'cut orchid-fibres' for 'yellow'. . . . It would appear that [of] the languages under study several . . . lack basic color terms other than 'brilliant' and 'dull'." (1967:288).

Those languages of the Highland New Guinea area which show Stage I terminology are the Upper Pyramid group, the Pyramid-Wodo groups and the Hitigima group of the Lower Valley. Upper Pyramid terms are *muli* 'black, green' and *mola* 'white, red, yellow'. Pyramid-Wodo terms are *muδi* 'black' and *moδa* 'white, red, yellow'. A descriptive term *getega* is cited for 'green', but is analyzed as a compound of the words for 'fresh' *get* and 'leaf' *ega*. Finally, the Tangma group of the Lower Valley (Lower Valley Hitigima) shows a simple two-term system with *muli* covering black and green and *mola* referring to white, red, yellow. (See Bromley 1967:305–306 for the 100-word Swadesh lists for these groups.) That we should find Stage I systems in Highland New Guinea is consonant with the association of simple color lexicon with simple technological and cultural development.

§ 2.3.2 *Stage II systems* [introduction of RED]

Stage II systems are found in several areas of the world, especially Melanesia, Australia, Africa, and parts of the New World. A typical example of such systems can be seen in Tiv, a Bantoid language of Nigeria. Paul Bohannan notes: "In Tiv . . . all green, some blues, and some greys are *ii*. But very light blues and light greys are *pupu*. *Nyian*, which covers brown, also covers all warm colors through red to yellow. The distinction between *ii* and *pupu* actually is not in terms of color, but in terms of what we would call shade—darkness and lightness. Very light blue, grey, or white are all *pupu*. *Ii* means dark and covers all dark colors and black—unless there is a warm color present; brown, red and yellow are all *nyian*. Tiv can distinguish colors and do color-blind tests, but their culture does not require—or allow—that they make some of the color distinctions that Westerners make. Westerners are the most color-conscious of peoples" (1963:35–36). A schematic representation of Tiv is seen in Figure 12.

A second African language exhibiting Stage II basic color

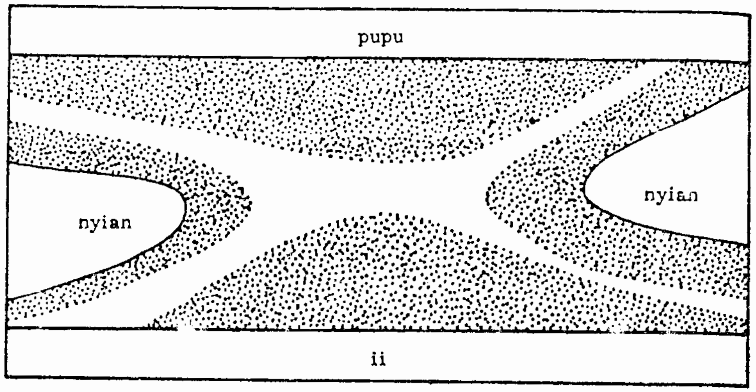

FIGURE 12. INFERRED COLOR CATEGORIES FOR TIV, REPRESENTING STAGE II

terminology is described by Turner (1966) for the Ndembu, a Benue-Congo speaking people of the Congo. Discussing in detail the ritual significance of color, Turner states: "This tripartite classification relates to the colours white [*tooka*], red [*ku-chinana*] and black [*wuyila*]. These are the only colours for which Ndembu possess primary terms. Terms for other colours are either derivates from these—as in the case of *chi-tookoloka* 'grey', which is derived from *tooka*, 'white'—or consist of descriptive and metaphorical phrases, as in the case of 'green', *meji amatamba*, which means 'water of sweet potato leaves'. Very frequently, colours which we would distinguish from white, red, and black are, by Ndembu, linguistically identified with them. Blue cloth, for example, is described as 'black' cloth, and yellow or orange objects are lumped together as 'red'. Sometimes a yellow object may be described as *'neyi nsela'*, 'like beeswax', but yellow is often regarded as ritually equivalent to red" (Turner 1966:47–48).

The Nasioi of Bougainville are another example of Stage II if the term for 'red' is indeed a basic term and not simply descriptive. (In the latter case the system would exemplify Stage I.) Eugene Ogan, in a personal communication, reports: "I worked a total of twenty-six months among Nasioi speakers. The only words I heard in regular use which might be described as 'color terms' were *kakara* 'white', mutaŋa 'black, dark' and erereŋ 'red'. The etymology of the last word is clear: ereŋ

'blood'. I know of no such etymology for the other two words." Nasioi is a non-Austronesian language.

An example similar to the Nasioi, where the term for red is also the word for blood, comes from Rivers' research on the aborigines of the Seven Rivers District, Queensland, Australia. "Most of these natives . . . seemed to agree in having only three definite words in their colour vocabulary, *viz.*, ŏti or owang for red and colours containing red, yŏpa or wăpŏk for white and light colours, and unma, or manara, for black and dark colours. Manara was the word used for the colour of the skin [and] . . . ŏti is said to be the word for blood" (Rivers 1901a:88).

Our arguments for the maximum extension of RED at Stage II to include not only high brightness hues such as 'yellow', 'orange', and 'pink', but 'brown' and 'violet' as well are given support by Rivers' summary of the literature.

"The absence of a word for brown appears to be characteristic of very many languages, probably of the great majority of the languages of the world. Among those which I have had an opportunity of investigating, I have found no word for brown in several Australian, Melanesian, and Polynesian languages, in Tamil, Eskimo, Welsh and the Arabic of the Egyptian peasant. The absence of a word for brown has been noted in many other races. Bastian notes that the Siamese call brown 'dam-deng' meaning 'black-red'. Kotelmann found that the Lapps called brown 'tscharpis roksad' again meaning 'black-red'. The Ainus call brown 'furiambe', red being fure. Pergens found that of the fifty-seven Congolese examined by him, only two could give a word for brown; one called it moindo, which was also used for black, and the other 'ossingaiumbayéta', m'bayéta being used for pink. Gatschet records that a word for brown is absent from several American Indian (Amerind) languages, while in others there may be several terms for this colour. It is possible that, in the latter case, the words used were names for special browns, as in Mabuiag, and were not true generic terms for brown . . .

"Schellong gives 'mela' as a word for brown in two Melanesian languages. This is probably the same word as 'mera', which is a common Melanesian term for 'red'.

"There appears to have been no word in Homeric Greek which one can regard as equivalent to brown, and I am indebted to a note from the Rev. H. T. F. Duckworth that the same is true of the Greek spoken by the majority of the inhabitants of Cyprus at the present day. They call dark brown objects μαυροσ which is the word in common use for black, while other brown objects are called κόκκινόζ, which is also applied to brilliant scarlet" (Rivers 1901a:68–69).

§ 2.3.3 *Stage III systems* [introduction of GREEN or YELLOW]

Stage III terminologies have been reported from several parts of the world. On the basis of our search of the literature to date, a large number are found in Africa, certain areas of Malaya and the Philippines, and Australia. We use Ibibio, a Nigerian language, as the exemplary case of Stage IIIa, as Elaine Kaufman (n.d.) gathered the data using our experimental method. Ibibio has basic color terms glossed 'WHITE', 'BLACK', 'RED', and 'GREEN', which are displayed in Figure 13A.

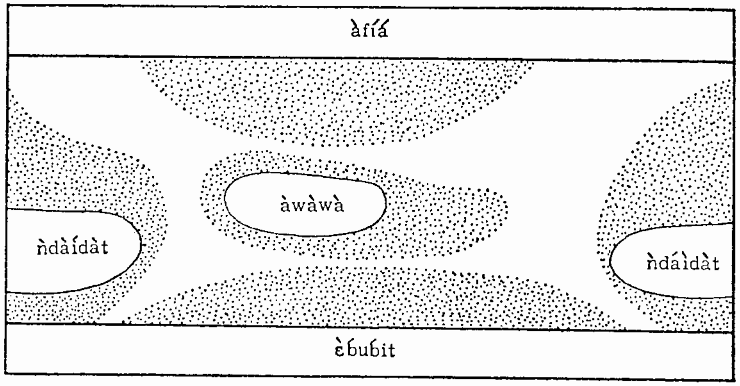

FIGURE 13A. INFERRED COLOR CATEGORIES FOR IBIBIO, REPRESENTING STAGE IIIa

Hanunóo, a Philippine language of Mindoro, represents Stage IIIa, but is somewhat variant in the extension of GREEN. The term for 'BLACK' in Hanunóo, *(ma) biru,* ranges over black, violet, indigo, blue, dark green, dark grey and deep shades of other colors and mixtures; 'WHITE' *(ma) lagtiʔ* includes white and light tints of other colors and mixtures; 'RED' *(ma) raraʔ* includes maroon, red, orange, yellow, and mixtures

in which these qualities are seen to predominate; 'GREEN' *(ma) latuy* covers light green and mixtures of green, yellow and light brown (see Conklin, 1955). That *(ma) latuy* is best considered a IIIa variant, rather than IIIb, is evidenced by Conklin's gloss of the term as "relative presence of light greenness; greenness" (1955:190). The inferred distribution of Hanunóo color terms can be seen in Figure 13B.

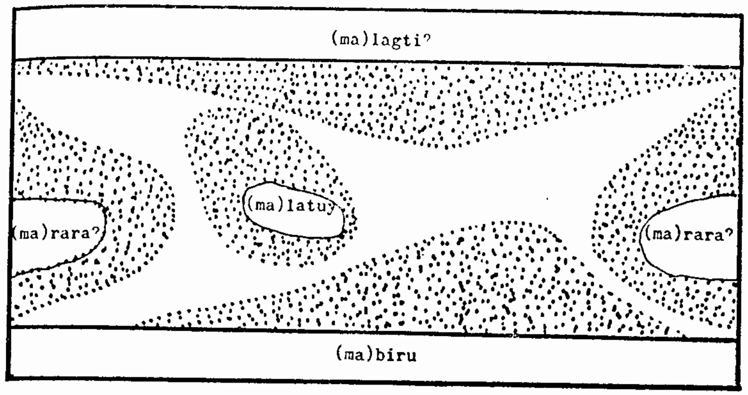

FIGURE 13B. INFERRED COLOR CATEGORIES FOR HANUNÓO, REPRESENTING A VARIANT OF STAGE IIIa

Rivers (1901a) reports two groups exhibiting Stage IIIa color vocabularies. One is found on Tanna Island in the Torres Straits, off the southeastern New Guinea coast. Another tribe is found along the Fitzroy River in Queensland. For the Tanna Island group, Rivers notes the terms *ratuan* 'white', *rapen* 'black', *laulau* 'red', and *ramimera* 'green.' There also exist several terms which appear to be simple modifications of the above basic forms. Thus 'brown' is *rapenmeruk* ~ *rapenakin* < *rapen* 'black'; 'purple' is *laulauakin* < *laulau* 'red'; 'orange' and 'yellow' are also derived from 'red', being termed *lauiha* and *lauihameruk,* respectively; 'blue' *ramimeraakin,* 'indigo' *ramimera-ramimera,* and 'violet' *ramimerabuk* all appear as derivations of *ramimera* 'green.' Rivers notes this feature when he describes the "free use of qualifying suffixes, red, purple, orange, and yellow being all named by some modification of one word [red] while green, blue, and violet were named by some modification of another [green]" (Rivers, 1901a:85).

There are a number of examples of Stage IIIb systems, that is, where YELLOW has emerged while green and blue hues continue to be included in BLACK (and to a lesser extent, WHITE) or designated by descriptives.

Ibo, a language of Nigeria, exhibits this variant of Stage III terminology. There are basic terms for 'BLACK' *oǰi*, 'WHITE' *nzu*, 'RED' *uhie*, and 'YELLOW' *odo*. The word utilized for green hues is a secondary (non-basic) color term *agwokwondu* meaning roughly 'it has the color of leaves' (Goldberg, n.d.). The Ibo distribution is seen in Figure 13c.

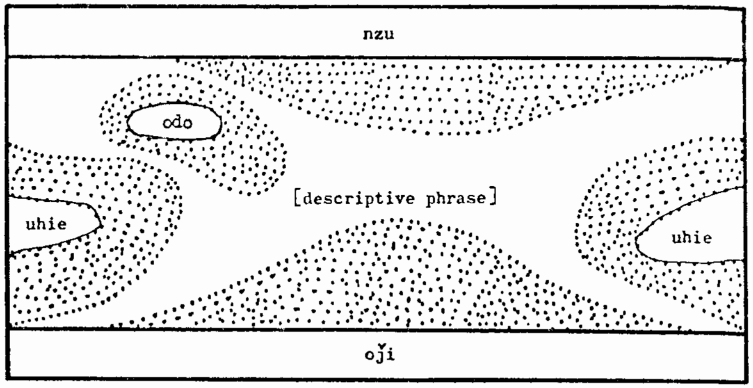

FIGURE 13C. INFERRED COLOR CATEGORIES FOR IBO REPRESENTING STAGE IIIb

Urhobo is also a IIIb system, with recent loan words for the indigenously unnamed green-blue area. Thus, we see terms for 'BLACK' *ɔbyibi*, 'WHITE' *ɔfuafu*, 'RED' *ɔBaBare*, and 'YELLOW' *ɔ̃do*. The English loans *grini* and *blu* refer to 'green' and 'blue' respectively and are best not treated as basic forms (*Ibid.*).

The Fitzroy River aborigines studied by Rivers (1901a) have four terms, *bura* 'white', *guru* 'black, blue, indigo', *kiran* 'red, purple', and *kalmur* 'yellow, green, orange, blue-green'. This is another example of a Stage IIIb system. In comparison with a simple Stage II system described for the Queensland group mentioned earlier, he notes: "in addition to definite words for red, white and black, the Fitzroy natives had a name 'kalmur' which they used for yellows and greens" (1901a:89). He summarizes his work on this group by noting that "there can be no doubt as to the main features of the colour terminology of these tribes. In all cases there were definite words for black, white, and red, the word for red being used also for purple and in some cases for orange. The Fitzroy natives seemed to differ from those of the Seven Rivers in that a fairly definite name for yellow and green [as a unitary category] had also been evolved. Blue and violet were by nearly all given the same name as black. There appeared to be no trace of a word for brown" (*ibid.*:89).

§ *2.3.4 Stage IV systems* [introduction of YELLOW or GREEN]

Stage IV terminologies are represented in many languages of the world. Our data show them to occur in large numbers in the New World and Africa.

In Central America we find Stage IV systems in many of the aboriginal languages of the area. To our knowledge, all of the twenty-six Mayan languages of Mexico and Guatemala exhibit Stage IV color terminology. We have chosen Tzeltal as the exemplary case of Stage IV as we have collected data from this language utilizing the experimental methods discussed earlier.[13]

Tzeltal has five basic color terms which are *ʔihk'* 'BLACK', *sak* 'WHITE', *cah* 'RED', *yaš* 'GREEN', and *k'an* 'YELLOW'. The distribution of these terms may be seen in Figure 14.

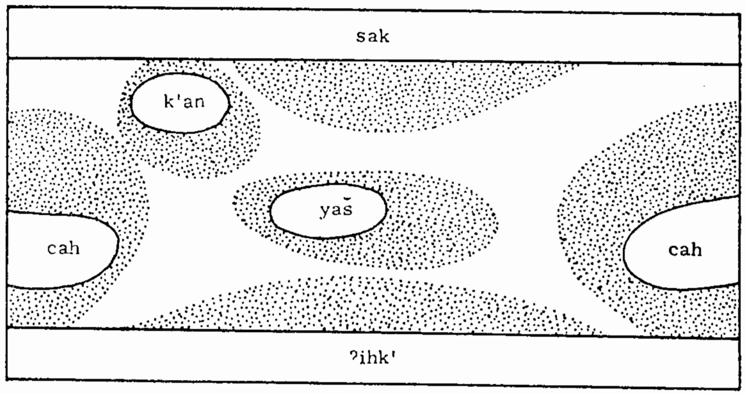

FIGURE 14. INFERRED COLOR CATEGORIES FOR TZELTAL, REPRESENTING STAGE IV

The treatment of the category *yaš* 'GREEN' in Tzeltal is of particular interest because some of the data suggest that this language may now be transitional from Stage IV to Stage V.

Of the forty Tzeltal informants from whom we gathered experimental data, thirty-one indicated that the focal point of *yaš* falls precisely in the area of the spectrum which corresponds to focal English green. In general usage, the maximum extension of *yaš* includes greens, blue-greens, blues and some blue-purples. However, when greater specification of *yaš* is requested, many informants restrict the term almost exclusively to greens and some blue-greens. 'Blues' and 'purple-blues' are recognized as a distinct area and are designated by a descriptive phrase, *ʔihk' ʔihk'tik šyašal* 'blackish green' or simply *ʔihk' ʔihk'-tik* 'blackish'. In at least one instance, an informant referred to this area by the Spanish term *azul* 'blue'.

The remaining nine informants in our sample of forty have essentially the same maximal extension of *yaš* as the previous thirty-one individuals (that is, over greens and blues) but the focal point of the category is in the blue area. When greater specificity is requested for the greens and blue-greens, descriptive phrases are often utilized, for example, *saksaktik šyašal* 'whitish green'.

Perhaps the most likely interpretation for these data is that Tzeltal is moving from Stage IV to V, and the ambiguity of the focus for *yaš* reflects the transition. It is apparent to all Tzeltal speakers that *yaš* includes two major *perceptual* centers, green and blue. In the contact with speakers of Spanish over the last 400 years, this fact has probably been accentuated many times. Speakers of Tzeltal respond by reducing the extension of *yaš* in instances where specificity is required either to greens (for most informants) or to blues (for the minority), treating the remaining area with a descriptive phrase. Tzeltal may continue for many generations to rely on such descriptives to designate what is clearly an incipient lexical category best glossed 'blue'. It is our prediction, however, that as Tzeltal speakers become more exposed to Spanish in the schools, *yaš* will eventually be restricted entirely to greens and that *azul* or some other Spanish

term will be adopted for the perceptual category 'blue', rendering Tzeltal a standard Stage V system.

Another New World Stage IV system can be seen in Tarascan, an unclassified language of the state of Michoacan, Mexico. Mary Foster, a linguist who has worked on Tarascan for several years, reports the following terms: *urá-* 'white,' *tuṛí-* 'black,' *čaṛá-* 'red,' *šuná-* 'green,' and *cipá-n-* (*pe*) 'yellow.' Foster indicates that a term 'blue' *ciránki* is "aberrant in that it doesn't occur with the adjectival *-pe* suffix. Gilberti's 16th century dictionary gives *cicípu* for blue. The word *ciránki* also means 'blue ear of corn' " (personal communication).

In Africa, we may cite as illustrative of Stage IV the color terminology of the Daza, a Nilo-Saharan group of Eastern Nigeria. Le Coeur (1956) reports the following terms: *cuo* 'blanc'; *yasko* 'noir'; *maaḍo* 'rouge'; *zẹdẹ* 'vert, bleu' (and perhaps in some cases, 'jaune clair' and 'violet'), and *mini* 'jaune'.

A second African system apparently of this stage is that of the !Kung Bushmen of South Africa. Richard Lee, in a personal communication, reports the following forms: *!gow* 'white, grey'; *žho* 'black'; *!gã* 'red, rust'; */ouŋ* 'green, blue, violet', and *gow* 'yellow, orange, tan'.

§ *2.3.5 Stage V systems* [introduction of blue]

So far, we have found Stage V systems in Africa, southern India, and the Philippines. Mandarin Chinese may also, on further investigation, prove to be a Stage V language.

A typical Stage V color vocabulary is seen in the Plains Tamil of South India. P. M. Gardner (1966a) reports the following terms: *veḷḷai* 'white'; *karuppu* 'black'; *sivappu* 'red'; *paccai* 'green'; *manjal* 'yellow' and *nīlam* 'blue'. The inferred distribution of these terms is seen in Figure 15.

Interpreting the report of Robinson (1925), we have classified Hausa as Stage V with the following forms: *fări*, 'white', *băḳi* 'black', *ja* 'red', *algashi* 'green', *nawaya* 'yellow,' and *shuḍi* 'blue'.

A second African group exhibiting basic terms for six colors is Nupe, a Niger-Congo language of the Kwa branch located in

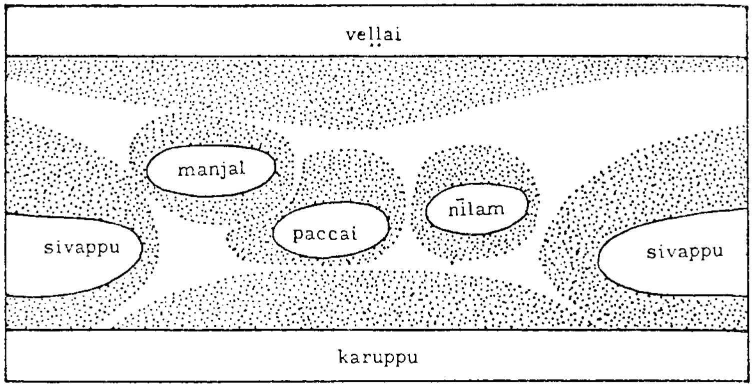

FIGURE 15. INFERRED COLOR CATEGORIES FOR PLAINS TAMIL, REPRESENTING STAGE V

Nigeria. Banfield and MacIntyre (1915) report *bókùṇ* 'white', *ẓìkò* 'black, dark blue', *dzúfú* 'red', *álígà* 'green', *wọṇjiṇ* 'yellow,' and *dòfa* '(light) blue'.

§ *2.3.6 Stage VI systems* [introduction of brown]

Stage VI systems, although rather sparsely represented in our sample, are found in southern India, Africa, and North America. The color terminology of Nez Perce, an American Indian language of the state of Washington, is depicted in Figure 16.

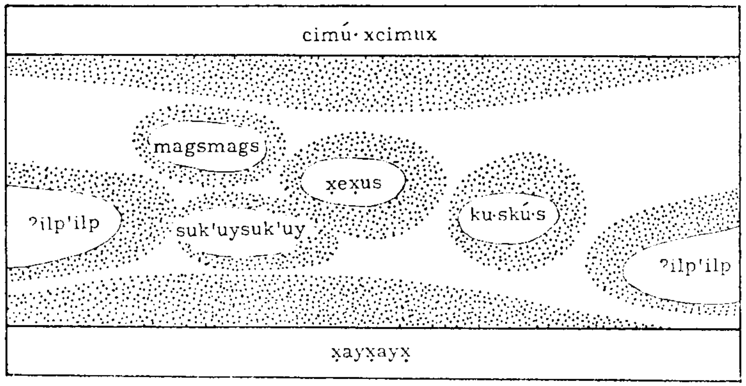

FIGURE 16. INFERRED COLOR CATEGORIES FOR NEZ PERCE, REPRESENTING STAGE VI

Aoki, who has worked on Nez Perce for several summers, reports, in a personal communication, the following terms: *cimú·xcimux* 'white', *x̣ayx̣ayx̣* 'black', *ʔilp'ilp* 'red', *x̣ex̣us* 'green', *magsmags* 'yellow', *ku·skú·s* 'blue', and *suk'uysuk'uy* 'brown'.

Stage VI is also seen in some dialects of Malayalam of southern India, for example, *vellá* 'white', *kaḍúpə* 'black', *čuwə́ppə* 'red', *paččá* 'green', *maṇṇá* 'yellow', *nīḷá* 'blue', and *tavíta* 'brown' (Goodman, 1963:9–10).

We have at least two examples of this stage in Africa, the Bari and the Siwi. Bari terms are *-kwe* 'white', *-rnö* 'black', *-tor* 'red', *-ngem* 'green', *-forong* 'yellow', *-murye* 'blue', and *-jere* 'brown' (Owen, 1908). Siwi terms are *aztùf* 'white', *amilàl* 'black', *azgahh* 'red', *ówràrr* 'green', *lasfàrr* 'yellow', *asmáwêĉ* 'blue', and *lasmàrr* 'brown' (Walker 1921).

§ *2.3.7 Stage VII systems* [eight-, nine-, ten-, and eleven-term systems]

Stage VII is represented by twenty of the ninety-eight languages in our sample, and varying types of this stage are found widely in the world's languages. As indicated in § 2.3 and in Table III, the most frequently occurring Stage VII systems exhibit all eleven basic color terms, *white, black, red, green, yellow, blue, brown, purple, pink, orange,* and *grey.* At least two of the languages in our experimental sample, Urdu and Cantonese, possess only eight basic color terms. We may tentatively treat these languages as early Stage VII systems. Urdu has terms for black, white, red, green, yellow, blue, brown, and purple, but lacks terms for orange, pink and grey. Likewise, Cantonese has yet to add brown, purple or orange to its basic inventory (see § 2.5). Tagalog lacks a term for orange as does Vietnamese. Finally, Catalan lacks pink and orange terms.

Hungarian presents a special case. It has basic terms for the ten basic categories exclusive of red and two basic terms for red. If this finding is borne out by further research, it may be possible to suggest developmental stages other than those already mentioned. Similarly, Russian, as well as several other Slavic languages, is reported to have two basic terms for blue: *siniy* 'dark-blue' and *goluboy* 'light blue'. The status of *goluboy* as a basic term is, however, not clear. The work of Istomina (1963) shows *goluboy* to be less salient and less well understood by Russian children than the Russian terms for red, green, yellow, dark-blue (*siniy*), orange and purple. Our own interviews with Russian-speaking informants are not conclusive but suggest that, for some speakers at least, *siniy* marks two categories—one includes *goluboy* and one contrasts with *goluboy*. Thus, depending on context, *siniy* has two senses, 'blue' and 'dark-blue', as illustrated in Figure 17. If this formulation is generally correct, *goluboy* must be considered a secondary

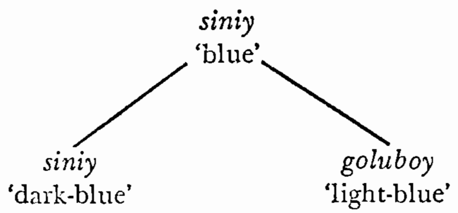

FIGURE 17. SEMANTIC RELATIONSHIPS OF RUSSIAN SINIY AND GOLUBOY

term in Russian. The same argument may perhaps apply to Hungarian *vörös* 'dark red'.

A total summary of the available data relevant to the evolutionary hypothesis from ninety-eight languages is given in § 2.6, where all interpretable reports are summarized and the stage, linguistic classification, basic color terms, and source of data are given for each language listed.

All languages examined confirm the evolutionary hypothesis in every detail except as noted in § 2.5. English, a typical Stage VII, eleven-term system, is depicted in Figure 10.

§ 2.4 *Internal linguistic reconstruction of basic color terms*

Our arguments concerning the development of basic color categories have been based primarily on the pattern of the distribution of such categories across contemporary languages. The partial ordering we found was seen to be most simply explained in terms of evolutionary assumptions. The evolutionary argument could be further strengthened by two kinds of evidence. The stronger kind would consist in the linguistic reconstruction of color vocabulary for one particular language family, for example, Indo-European. Some early philological work of Gladstone (1858) and Geiger (1880) moved in this direction but their work lacks careful application of the comparative method (see Appendix III). What is clearly needed is a modern reconstruction of Indo-European color terms.

We do, however, have considerable independent evidence of a weaker kind: internal linguistic reconstruction. This method is a common procedure in historical linguistics. The relevance of internal reconstruction for ethnology was best stated by Sapir in his classic *Time Perspective* monograph (1916). The method has been recently employed by Romney (1967) in his reconstruction of Yuman kinship terminology.

In regard to the internal reconstruction of color vocabulary, at least two assumptions of the method are primary:

(1) Color terms that can be shown on linguistic grounds to be loan words are likely to be more recent additions than native color terms.

(2) Color terms that are analyzable are likely to be more recent additions than unanalyzable terms. Analyzability may take five forms:

   (i) color terms containing derivational affixes are more recent additions than color terms not containing derivational affixes;

   (ii) color terms containing more than one stem are more recent additions than those containing a single stem;

   (iii) color terms which contain analyzable stems and/or affixes are more recent additions than those which contain unanalyzable stems and/or affixes;

   (iv) color terms containing an affix whose gloss is 'color, -colored, color of-', and so on, are more recent additions than those not containing such an affix;

   (v) color terms that are also the names (or contain the names) of objects characteristically having the color in question are more recent additions than color terms which are not (or do not contain) such a name (see § 1.2).

If our evolutionary theory is correct, one would expect that the terms acquired in Stage VII can be shown to be more recent than the Stage VI terms; that the term added at Stage VI is more recent than those of Stage V, and so on. Terms at Stage I should be the oldest in every language considered.

The evolutionary theory is generally corroborated when principles of internal reconstruction are applied to our data. In many of the Stage II systems reported, the term for RED can be seen to be derived from the word for 'blood' [for example, Mid-Grand Valley Halyhalymo *mepmep* < *mep* 'blood' (Bromley, 1967); Nasioi *eseręŋ* 'red' < *ereŋ* 'blood' (Ogan, in a personal communication); Queensland aborigines *ŏti* 'red' < *ŏti* 'blood' (Rivers, 1901a)], while terms for BLACK and WHITE lack known derivations.

The material presented by Rivers (1901a) for several of the Torres Straits groups is interesting in this light. In the so-called "Western Tribes" of this area, four of the six terms elicited as being "names in general use" are formed by the use of a productive derivational suffix, *-dgamulnga* 'it looks like', plus the name of some natural object. Thus we see *kulkadgamulnga* 'red and purple' < *kulka* 'blood', *murdgamulnga* 'yellow and orange' < *mur* 'yellow ochre', *ildegamulnga* 'green and blue' < *il* 'gall-bladder, bile', *maludgamulnga* 'blue and green' < *malu* 'sea'. The forms for 'black' and 'white' are less amenable to analysis, Rivers being unsure of the derivation of 'white', that is, *miakalunga* ~ *merkalunga* < *merkai?* 'spirit'. The term for 'black' *kubikubinga* is said to be derived from *kubi* 'charcoal, night and darkness', but is formed by a distinctive derivational principle, reduplication of the root plus *-nga*. It is likely that the terms for 'black' and 'white' are older than the others, although we have no way of ordering the remaining terms. If we accept Rivers' account that the latter are basic color terms, this group must be classified as Stage IV or V. If, on the other hand, they are descriptive phrases, as the internal evidence suggests, then an assignment to Stage I is more appropriate. The latter interpretation is given some credence when Rivers states that "names for unfamiliar colours were apparently invented for the occasion by adding the usual suffix [that is, *-dgamulnga*] to the name of some natural object and once or twice a native omitted the termination and simply gave the name of the object" (1901a:59).

A comparable situation is seen in the language spoken on Murray Island, again drawing on Rivers' Torres Straits materials. Unlike the "Western Tribes" reported above, Murray Island color words are formed by "reduplication from the names of various natural objects" (1901a:56). Thus, we find *mammam* 'red' < *mam* 'blood', *bambam* 'orange, yellow' < *bam* 'turmeric', *siusiu* 'yellow' < *siu* 'yellow ochre', *sŏskĕpusŏskĕp* 'green' < *sŏskĕp* 'bile, gall-bladder', *bulubulu* 'blue' < English 'blue', *kakekakek* 'white' < ?, *golegole* 'black' < *gole* 'cuttlefish', *pipi* 'grey < *pi* 'ashes'. The term for white was the only common expression for which Rivers found it impossible to obtain a derivation, and the derivation he offers for black is suspicious. By eliminating *bulubulu*, clearly an English loan, Murray Island might be interpreted, on internal evidence, as a Stage I system. That such an interpretation is plausible can be seen when Rivers notes, "It is interesting here that of the words in common use I only failed to obtain the derivations of the words for 'white' and of *sunursunur* and *akosakos*, meaning respectively 'bright' and 'dark or dull'. . . . All of the other names used for colours were found to be derived from natural objects which could be identified" (1901a:56).

One point should be made here concerning what might be considered incipient color categories and Rivers' contribution in this regard. While Rivers notes several times that "many of these . . . names were devised on the spur of the moment" (*ibid.*), he is nevertheless impressed by the high reliability of the more common descriptives. He suggests that this material may be taken as illustrative of vocabulary accretion in the domain of color, and that it should not be surprising when a new color category is linguistically recognized that it is labelled by the names of natural objects. Rivers concludes, "It is probable that when primitive man began to use names for colours, he used the names of natural objects either simply or modified in some way, and that definite generic terms have evolved out of these. The Mabuiag vocabulary [Western Torres Straits Tribe] is a good example of the coexistence of a large number of special names with a few which have become definitely abstract terms for colour [that is, black and white]" (1901a:63–64). This fact is borne out in many languages where, for example, the word for red may be seen to have been derived from a form of the word for blood (Greenberg, 1963:154).

The internal reconstruction for Swahili is interesting because it may be Stage II, having relatively old terms only for 'BLACK' *nyeusi*, 'WHITE' *nyeupe* and 'RED' *nyekundu*. The term for 'green' *kijani* may be new as it can be glossed 'leaf green'. The remaining terms are descriptives or loan words, that is, *kijivu* 'grey' < 'ashes', *chungwa* 'orange' < 'orange fruit', *khudhurungi* 'brown' < Arabic 'brown', *kimanjano* 'yellow' < 'turmeric', *bulu* 'blue' < English 'blue', and *urujuani* 'purple' < Persian 'purple'.

Korean is an interesting example which illustrates the effect of foreign influence on the formulation of new color terminology. Korean has basic color terms (bound forms accompanied by a suffix meaning roughly 'color') for 'BLACK', 'WHITE', 'RED', 'GREEN', and 'YELLOW'. These expressions are clearly indigenous Korean forms. Terms for pink, orange, (chestnut) brown, brown, green, blue, purple, and grey, however, are of obvious Chinese derivation, as can be observed in the following forms. The Old Korean terms are: *kkamahta* 'BLACK', *hayahta* 'WHITE', *ppalkahta* 'RED', *nolahta* 'YELLOW', and *palahta* 'GREEN'. The Chinese loans are: *pwunhongsayk* 'pink', *tungsayk* 'orange', *kalsayk* 'brown', *pamsayk* '(chestnut) brown', *noksayk* 'green', *changsayk* 'blue', *casayk* 'purple', and *hoysayk* 'grey'.

Cantonese Chinese has also only recently reached Stage VII, judging by internal reconstruction of its color vocabulary. In dictionaries of one hundred years ago, the term for 'pink' *tsï* does not occur. The present meaning can be shown to be best translated as 'water colored'. The terms *luk* 'jade colored' and *l'ām* 'artifical blue' are also recent category labels which now segment GREEN. We may, therefore, reconstruct a Stage IV

Cantonese with the following terms: *pāk* 'WHITE', *hɒk* 'BLACK', *hung* 'RED', *ts'eng* 'GREEN', and *uong* 'YELLOW'.

That we find *fūi* 'grey' is somewhat anomalous. However, there is some evidence that it refers to 'ashes', and, if so, can be eliminated.

The appearance of new terms in some of the European languages is also indicative that, on internal evidence, these languages can be reconstructed to earlier stages. Bulgarian, for example, has borrowed terms *oranž* < French *orange*, *moravo* < (possible) Venetian *morado* 'purple'. Similarly, on internal evidence, the Hungarian terms *rózsaszín* 'pink', *barna* 'brown', *lila* 'purple' and *narancs* 'orange' appear to be late loans from Indo-European languages.

The term for blue, which appears at Stage V, is frequently a loan word. Rivers makes an interesting observation of this fact. He notes, "The English word [blue] has been borrowed by many African races, often taking the form of 'bru'. The Maoris use the English word changed into 'puru'. The Battas of Sumatra use the word 'balau' borrowed in a slightly modified form from the Dutch. They are also said to have borrowed the word 'biru' from the Malays, but this is probably a modification of the English word.[14] Some races in Borneo are said to use a word 'hidjan' borrowed from the Malay, and the Berbers are said to use a word 'samawi' (sky colour) borrowed from Arabic. The Hindustani word 'nil' is used for green and blue by several Asiatic peoples including the Tamils and Siamese.

"The Samoyeds sometimes use the Russian word 'sjinioi' for blue. In the Philippine Islands, the words used for green and blue by several tribes, such as the Ilocos, Tagals, and Bisayos, have been borrowed from the Spanish, and one of the Araucans of South America examined by Kirchhoff also called blue 'azul'" (1901a:67–68).

§ 2.5 *Problematical cases*

The vast majority of languages examined so far conform to our notions about the universality of color term foci as well as the evolutionary sequence of basic color terms. However, there are several problematical examples.

If we consider the questions raised by the sample of twenty languages for which we have experimental data, we note problems in the interpretation of Catalan, Cantonese, Mandarin, Japanese and Vietnamese. Catalan is clearly Stage VII but there appears to be some doubt, at least for the informant consulted, that the term for black is a basic, rather than secondary, color term. Corson (n.d.) reports that his Catalan informant realized that English 'black' was not a 'kind of grey' but consistently maintained that Catalan *negre* 'black' was a kind of *gris* 'grey'. This is the only example in our data where the status of black as a basic color term is questionable, and more data are clearly needed from additional Catalan speakers.

Our data from Cantonese and Mandarin Chinese present several problems in relation to the evolutionary hypothesis. We have treated Mandarin as an example of Stage V, with terms for black, white, RED, green, YELLOW and blue. There is also a term for grey which is the same as the word for 'ashes'. For one informant, who we later discovered is not a native speaker, (McClure, n.d.) this term is reported as basic; for several other informants (Madarasz, n.d.) grey is given as a tertiary form. Given these discrepancies, and the pattern pressure from the remaining data, we have treated Mandarin as Stage V and plan to obtain more data for this language in future research.

The problem with Cantonese is analogous. There exist terms for white, black, RED, green, YELLOW and blue (which would make it Stage V), but there are also terms for pink and grey. There is no term for brown, this category being included in yellow (Stross n.d.). There is reason to require more data for this language, however; several of the forms (pink, blue, grey) appear to be recent and their status as basic terms is as yet unclear.

Japanese also presents a problem in relation, not to its current state, but to its internal reconstruction. On the basis of internal evidence, the term for Japanese 'blue' *ao* is apparently of greater antiquity than 'green' *midori* (*iro*). Moreover, there is some evidence that *ao* once was extended over greens and blues. If this is the case, we have a situation where the unitary term GREEN (at Stage IV) has its focal point in 'blue' and eventually reduces to blues exclusively with the later appearance of the term for green (at Stage V). If these conjectures are borne out by further work, we will have no alternative but to treat Japanese as a counterexample to the evolutionary sequence of the foci blue and green. However, alternative and equally plausible interpretations can be made which conform to the theory here presented. Final decision of the matter must await further research.

Vietnamese must be mentioned because it appears to lack a term for 'blue' but has basic terms for black, white, red, green, yellow, pink, purple, brown, and grey.

Turning to data derived from the literature and from personal communications, we note problems in the treatment of Western Apache, Hopi, Papago, all languages of the Southwestern United States; Samal, a Philippine language spoken off the Island of Mindanao; and Malay.

Materials from Western Apache (Keith Basso, in a personal communication) constitute an exception to the partial ordering of rule (1). A term for 'brown' *łibaha* appears contemporaneously with a unitary term for GREEN *dukliž*. In reference to the possible segmentation of *dukliž* 'GREEN', Basso notes "So far as I know this term, which covers a wide range of blues and greens, is not segmented linguistically at the basic color term level. Some referents include: the color of turquoise, which can range from light sky blue to rich 'Kelly' green; the color of all grasses . . . the color of all bush and tree leaves; the color of the eyes of an Appaloosa horse (perhaps the lightest blue there is); the color of an under-water algae . . . which is perhaps the darkest green." About the problem of whether the Western Apache term for brown *łibaha* is basic, Basso writes: "I believe that łibaha is unambiguously a basic color term, and best gloss I can come up with is 'brown'. Some referents: the color of sun-dried adobe bricks, actually a 'reddish brown' or 'rusty'; the color of the robes worn by early Lutheran missionaries (a 'most typical' brown form); the color of horses that you and I would refer to as 'bay'; the color of all leathers (treated or untreated) except for those dyed 'red', 'black' or one of the other basic colors that I described [above]" (*ibid.*).

Hopi (Voegelin and Voegelin, 1957) is analogous to Western Apache in that a sixth term is present while GREEN remains a unitary category including greens and blues. Unlike Apache's term for brown, Hopi includes a basic term for 'grey' *masi*. If grey proves to be a secondary form, Hopi will be a perfect Stage IV system.

Samal is problematical because Geoghegan, in a personal communication, reports *ʔabu* 'grey' as a basic color term, even though the expression is literally glossed 'ash'. If *ʔabu* eventually proves to be a descriptive, Samal will be classified as Stage V, with terms for black, white, red, green, yellow and blue.

Papago, as reported by K. Hale, in a personal communication, presents a similar problem. This language contains basic terms for white, black, red, yellow, green (including blue), and grey. If it were not for the presence of grey, Papago would be unequivocally Stage IV.

Malay and Bahasa Indonesia are Stage VII systems, lacking only a term for pink, and thus present no synchronic problem. However, the Stage VI and VII terms show a pattern of borrowing which does not fit the evolutionary sequence perfectly. 'Brown' is *tjokolat* (M) and *tjoklat* (I) < English or Dutch 'chocolate'. Similarly the forms *djinggo* (M) and *oranje* (I) 'orange' are obvious borrowings. Pink, as mentioned above, is absent. 'Grey' is *kelaboe* (M) and *kelabu* (I) < *abu* (M) 'ash'. However, we find for 'purple', *ongo* (M) and *ungu* (I) a simple root, attested also in Javanese (*wuŋu*), having apparently no meaning other than the abstract color term.

While internal reconstruction suggests that the purple term could be older than the brown term, such an interpretation is by no means necessary. The history of many language families, including Indo-European, shows that borrowing a foreign form for a basic color category may serve either to encode a previously uncoded perceptual category or to replace a native form. For example, the French form *bleu* was probably borrowed from Germanic for a previously uncoded category, while *blanc* ~ *blanche*, also of Germanic origin, almost certainly replaced a Romance form.[15]

In sum, of the ninety-eight languages considered, there is no counter-example to the finding of universality of the eleven color category foci, and there are just six serious candidates for counter-examples to the evolutionary ordering, which are: (a) the absence of brown in Cantonese; (b) the absence of blue in Vietnamese; (c) the presence of brown in Western Apache; and (d) the presence of grey in Hopi, Samal, and Papago (and possibly Mandarin).

The only systematic error, then, is the premature appearance of grey. If additional cases of this type are found the theory might have to be revised, perhaps by letting grey occur as a wild-card at various points in the evolutionary sequence, say at any point after Stage IV. Such a revision would have a certain plausibility as grey is exclusively a brightness term and thus might be partially immune to the constraints governing the progressive lexical partitioning of hue. However, we do not feel that three out of ninety-eight cases is a large enough number to justify a revision at this time.

§ 3 THE DATA

This section includes the data from the ninety-eight languages on which our analysis has been based. The materials presented here have been drawn from published sources and personal communications with linguists and ethnographers who have specialized knowledge of the languages in question. These data are summarized in Table III.

The order of presentation in this section is in terms of evolutionary stage, moving from Stage I sequentially through Stage VII. Ordering within stages is alphabetical by language name. (An alphabetical listing of all languages considered is found in Appendix III).

The following information is provided for each language considered:

Language name	(as given in source) (Stage I, II, and so on)
Linguistic classification	(Major family or stock and finer information where useful for purposes of identification)
Geographical area	(continent and regional location)
Source	(literature, personal communication, and so on)

The results of Lenneberg and Roberts' mapping procedures indicate that there were color chips included in categories glossed 'red', 'green', 'yellow', 'brown', and 'purple' for Zuni monolinguals for which there was perfect unanimity in naming. It is of interest to note that the Zuni mappings are in perfect agreement with our findings concerning the universal foci of these categories (see Lenneberg and Roberts, 1956:26).

§ 4 SUMMARY OF RESULTS AND SOME SPECULATIONS

Our research to date points to three main conclusions. First, there exist universally for humans eleven basic perceptual color categories, which serve as the psychophysical referents of the eleven or fewer basic color terms in any language. Second, in the history of a given language, encoding of perceptual categories into basic color terms follows a fixed partial order. The two possible temporal orders are:

$$\begin{bmatrix}\text{white}\\ \text{black}\end{bmatrix} \rightarrow \text{red} \rightarrow \text{green} \rightarrow \text{yellow} \rightarrow \text{blue} \rightarrow \text{brown} \rightarrow \begin{bmatrix}\text{purple}\\ \text{pink}\\ \text{orange}\\ \text{grey}\end{bmatrix}$$

and

$$\begin{bmatrix}\text{white}\\ \text{black}\end{bmatrix} \rightarrow \text{red} \rightarrow \text{yellow} \rightarrow \text{green} \rightarrow \text{blue} \rightarrow \text{brown} \rightarrow \begin{bmatrix}\text{purple}\\ \text{pink}\\ \text{orange}\\ \text{grey}\end{bmatrix}$$

Third, the overall temporal order is properly considered an evolutionary one; color lexicons with few terms tend to occur in association with relatively simple cultures and simple technologies, while color lexicons with many terms tend to occur in association with complex cultures and complex technologies (to the extent that complexity of culture and technology can be assessed objectively).

The early stages of development of color lexicon show a haunting parallel with the early Jakobson-Halle (1956) theory

of phonological development—haunting because although the strength of the analogy is unquestionable, the reason such an analogy should exist at all is far from clear.

Sound and color are both wave phenomena. Hence both may be described in terms of (i) total energy or amplitude; (ii) frequency, or inversely, wavelength; (iii) purity of wavelength, and so on. In particular, total energy corresponds in sound to loudness and in color to brightness; frequency corresponds in sound to pitch and in color to hue; purity corresponds in sound to musicality or "compactness" (as opposed to "diffuseness") and in color to saturation.

The developmental sequence of phonological contrasts of which Jakobson and Halle write is ontogenetic, referring to the development in the infant (and also the sequence of loss in the aphasic). On the other hand, the sequence of color categorization we describe is "phylogenetic"—the "phyla" in this case being cultural rather than biological.

As in the case of color, phonology begins with two categories, rather than one. Jakobson and Halle call this the "labial stage" after the usage of psychopathologists (1956:36). The first utterance of the infant may be rendered /pa/. There is no one-segment utterance. "The diffuse stop [that is, /p/] with its maximal reduction in the energy output offers the closest approach to silence, while the open vowel [that is, /a/] represents the highest energy output of which the human vocal apparatus is capable" (1956:37). The initial contrast is thus one of minimal energy /p/ versus maximal energy /a/. The first stage is paralleled in color categorization with the opposition WHITE, maximum brightness (= maximum energy) versus BLACK, minimum brightness (= minimum energy). The parallel in this and subsequent stages is shown in Figure 18.

At Stage II both sound and color see the introduction of the frequency dimension. "After the appearance of the contrast CV [that is, /pa/], founded upon one attribute of sound, loudness, the utilization of the other basic attribute, pitch, is psychologically inferable. Thus the first tonality opposition is instituted. . . . In /p/ the lower end predominates, while in /t/ the upper end is the stronger one" (1956:38). The advent of the frequency dimension in sound is paralleled by the introduc-

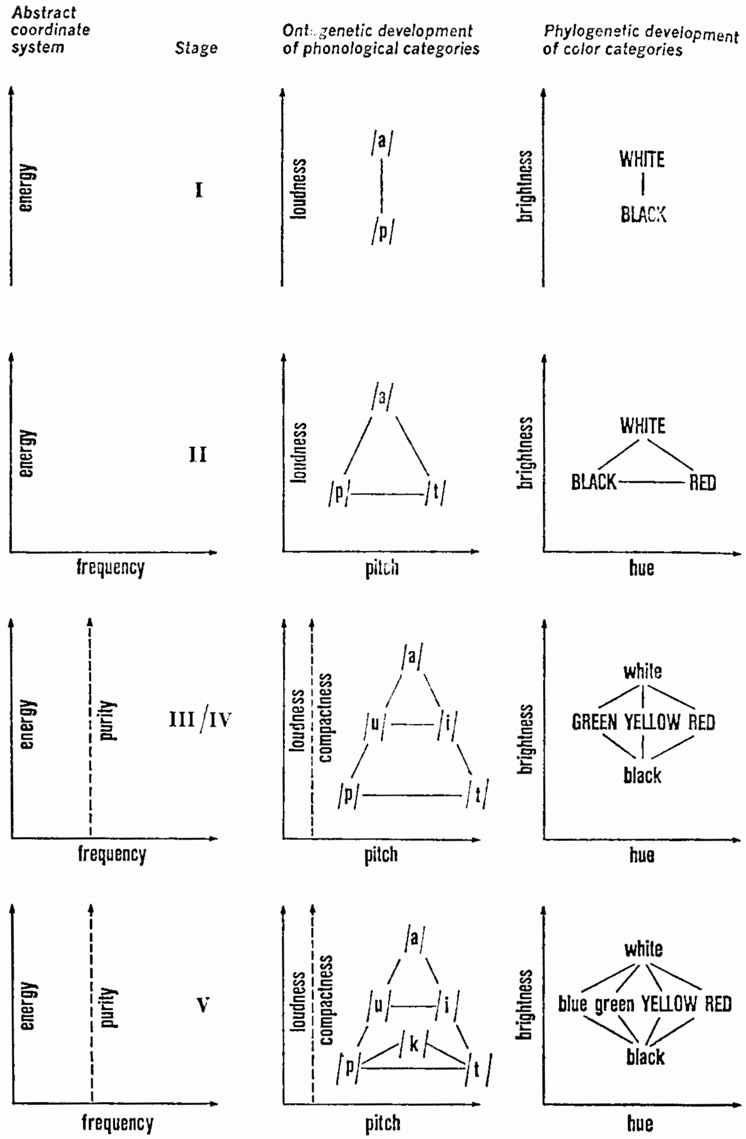

FIGURE 18. PARALLELS IN DEVELOPMENTAL SEQUENCE OF PHONOLOGICAL AND COLOR CATEGORIES.

tion of the hue, RED, in color. Since BLACK continues to name much more of the cool-hued space than WHITE and since RED is focally a low brightness color, BLACK and RED contrast jointly with WHITE on the brightness dimension and with each other in relation to hue.

After Stage II the parallel between speech sounds and color development is less perfect. Nevertheless, we see on either side a progressive splitting of existing categories in terms of either the basic amplitude and frequency dimensions, or dimensions derived from these, for example, purity (that is, uniformity of frequency over the entire wavefront).

Stage III introduces the purity dimension in phonology with the emergence of a diffuse vowel. Color, however, does not appear ever to introduce its purity dimension, saturation, as a *distinctive* feature of basic categories. Rather, it continues distinctions in terms of hue with the emergence of GREEN, which names all cool hues in contrast to RED.[16]

The hypothesized single diffuse vowel soon divides on the acute/grave (frequency) axis, while an additional point on the hue (frequency) dimension is established for color, normally YELLOW. By the end of Stage IV we have the analogous, but not quite isomorphic, structures displayed in the third row of Figure 18. At Stage V the purity or compactness dimension is reapplied to the consonants, establishing /k/, while blue emerges in color. Two fairly stable structures are established which may or may not be elaborated by reapplication of dimensions already employed.

Jakobson and Halle perceived the analogy between sound and color-distinctive oppositions long before the current research was undertaken, and apparently without cognizance of the nineteenth century work on color evolution:

> a cautious study of synesthetic associations between phonemic features and color attributes should yield clues to the perceptual aspects of speech sounds. There seems to be a phenomenal affinity between optimal chromaticity (pure red) and vocalic compactness, attenuated chromaticity (yellow-blue) and consonantal diffuseness, attenuated chromaticity (greyed [sic]) and consonantal compact-

> ness; moreover between the value axis of colors and the tonality axis of language (1956:33; fn. 29).

Perhaps Jakobson and Halle are right concerning "phenomenal affinities" with regard to synesthetic responses, but our results on the developmental sequence for color would suggest association of the amplitude with amplitude, and frequency with frequency, dimensions rather than the cross-over (amplitude with frequency and *vice versa*) that Jakobson and Halle seem to suggest.

Having already loosely employed an ontogenetic/phylogenetic metaphor in discussing the parallel between the Jakobson-Halle theory of phonological development in the infant and our results concerning the evolution of basic color terms in languages, it is hard to resist the temptation to push the metaphor one step further. The extension is that the same sequences hold in phonological development phylogenetically and in the development of color categorization ontogenetically. With respect to phonology, Jakobson and Halle appear to have in mind a developmental pattern within languages based on the same kind of distributional evidence across languages we find in color nomenclature.

> Both the vocalic and the consonantal pattern may subsequently pass from the triangular to the quadrangular pattern by superimposing the distinction between velar and palatal upon the wide vowels and/or upon the consonants. *In the languages of the world,* however, the triangular pattern prevails over the quadrangular for vowels and even more so for consonants—it is the minimum model, both for the vocalic and for the consonantal patterns, with the very rare exceptions when either the vocalic or the consonantal pattern —but never both—is linear. In the rare cases of a linear patterning, the vowels are confined to the feature compact/diffuse and the consonants, almost unfailingly, to the tonality feature. *Thus no language lacks* the oppositions grave/acute and compact/diffuse, whereas any other oppositions may be absent (1956:4, italics added).

About the development of color nomenclature in the child there has been surprisingly little reported research to date, despite the considerable study that has been devoted to the child's development of color perception, color preference, and so on. In fact, we are aware of no study in English on the development in children of mastery of the reference of color words, although some may have escaped our notice. Professor Dan Slobin, however, has called our attention to some Soviet work on the subject, which shows that Russian children tend to acquire control of the meanings of color terms in essentially the same order our results show them to be acquired by languages (Istomina, 1963).

A fundamental problem which remains unsolved is the explanation for the *particular* ordering found. Given that cultural evolutionary factors may explain the gross numerical growth in size of basic color vocabulary, why are terms added in a partially fixed order and why in this particular order? Our essentially linguistic investigations have led, seemingly inescapably, to the conclusion that the eleven basic color categories are pan-human perceptual universals. But we can offer no physical or physiological explanation for the apparently greater perceptual salience of these particular eleven color stimuli, nor can we explain in any satisfying way the relative ordering among them. Existing theories of color perception, both classical and recent, offer several plausible suggestions for parts of the observed pattern, but none will serve as the basis of an adequate explanation.[17]

Perhaps we have here in the domain of semantics a finding analogous to some phenomena recently recorded in the areas of syntax and phonology. Chomsky (1965) and Lenneberg (1967) have argued that the complexities of language structure, together with some known limitations of human neurophysiology, imply that human language cannot be considered simply a manifestation of great general intelligence. Rather it must be recognized as a species-specific ability, ultimately based on species-specific bio-morphological structures. What the particular biological structures underlying particular linguistic functions may be, it is not possible to say at this time in any detail. The study of the biological foundations of the most peculiarly and exclusively human set of behavioral abilities—language—

is just beginning (Lenneberg 1967), but sufficient evidence has already accumulated to show that such connections must exist for the linguistic realms of syntax and phonology. The findings reported here concerning the universality and evolution of basic color lexicon suggest that such connections are also to be found in the realm of semantics.

Appendixes