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Berlin and Kay's Theory of Color Universals and Linguistic Relativity: The Case of Arabic

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Abstract: The aims of this study were to describe the basic color terms (BCTs) of Arabic and, in particular, clarify the relationship among the three Arabic terms for blue: azrock, samawee, and khuhlie. Data were collected from child and adult native Arabic speakers from schools and universities in Riyadh using a list task and a naming task. In the list task, the children's sample included 113 boys and 140 girls, aged 8 to 12 years, while the adult sample (N = 200) was made up of equal numbers of men and women, aged 18 to 25 years (mean = 20 years). The task involved writing down as many color words as they knew, in four minutes for the children, and one minute for the adults. The pattern of results from the two samples was essentially the same: the terms ordered by their frequency from 100 to 38 percent were ahmar "red", azrock "blue", akhdar "green", asfer "yellow", asswed "black", abiyadh "white" boartoogaalee "orange", bonee "brown", wardee "pink", banafsagee "purple", and rassasee "grey". In addition, samawee "light blue" was provided by 40 percent of the sample. This is followed by a drop in the frequency scores, with khuhlie "dark blue" being included in 38.6 percent of the responses. In regard to the color naming task, the child sample included 30 boys and 30 girls, aged 8 to 12 years, while the adult sample (N = 60) include equal numbers of men and women, aged 18 to 28 years. The task involved naming each example of a set of 65 colors representing the whole color palette. The two samples again performed similarly. The terms with the highest measures of usage and consensus were ahmar, azrock, akhdar, asfer, asswed, abiyadh, boartoogaalee, bonee, wardee, banafsagee, and rassasee. Based on these results, it appears that Arabic has 11 basic color terms that correspond to Berlin and Kay's (1969) universal terms. In addition, the terms of particular interest — samawee ("light blue") and khuhlie ("dark blue") — are not basic Arabic color terms.

Key words: Basic color terms, basic category, color words, salient terms

1. Introduction

Although all humans with normal trichromatic color vision have the same general physiological basis of color vision (Mollon J. D., 1999), there is noticeable diversity among languages in the way they categorize the continuum of visible colors. Some languages are reported to use as few as two terms to describe all colors (Heider E. R., 1972); others use many more (Kay P., Berlin B. and Merrifield W., 1991; MacLaury R. E., 1987). Although a considerable amount of material has been written on this subject, relatively little has been written on color terms in Arabic.

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This paper reports two experiments conducted within the framework of Berlin & Kay's (1969) theory of universal colour categories to identify the "basic color terms" (BCTs) of Arabic. Pilot work had suggested that Arabic might have more than one BCT for the blue region — *azrock* "blue", *samawee* "light blue" and *khuhlie* "dark-blue" — and thus a subsidiary aim was to investigate this possibility. Experiment 1 used the method of elicited lists which is a simple and fast method of identifying likely BCTs Davies I. R. L. & Corbett G. G. (1994); Özgen E. and Davies I. R. (1998). It provides two measures — frequency of use and order of occurrence — and assumes that the psychologically more salient terms will appear in more lists and in higher positions than less salient terms. Pich J. & Davies I. (1999) found that primary categories (WHITE, BLACK, RED, GREEN, YELLOW, and BLUE) appeared more frequently than derived categories (BROWN, PINK, ORANGE, PURPLE, and GREY). They also found that, in general, the 11 BCTs (both primary and derived) were more frequently used than non-BCTs. The second experiment required participants to name a representative sample of color-stimuli (those used by Davies I. R. L. & Corbett G. G. (1994), 1997, and Özgen E. and Davies I. R. (1998) under controlled conditions. This method assumes that BCTs have specific perceptual referents and, consequently, participants will agree on names for these referents.

1.1 Berlin and Kay's Theory of Color Universals

In 1969, Brent Berlin and Paul Kay devised their seminal theory of color universals that proposed the existence of semantic universals in color vocabulary. In addition, the theory also proposed that all languages acquire their tokens of the color universals in one of a small number of possible sequences. They derived the theory partly from studies of native speakers of 20 different languages including samples of all major linguistic families, and partly from published language descriptions such as dictionaries.

They gathered their data in two stages. In the first stage, the list task, informants wrote down as many color terms as they could in their native language. After this, the informant was given a stimulus board consisting of 320 Munsell color chips[1] as shown in Figure 1. For each color term informants used in the first stage, they were asked to indicate all chips that were exemplars of each term, and to indicate the best exemplar of each term.

Figure 1 The World Color Survey (WCS) Array of Munsell Color Chips

Although there was considerable variation across languages in both the number of color terms and the colors included in the terms, the distribution of the best or most typical examples (the prototype) of color terms was not so variable. They claimed that most of these were placed in just a few areas of the Munsell chart and that the foci of these color terms were more or less the same for all languages. These "universal foci" were to have a central

[1]Munsell chips are small pieces of cardboard which are painted in carefully controlled pigments, so that the colors of the chips are systematically spaced over the range of all possible colors, at least in as far as it is possible to create the appropriate pigments. Munsell chips, and the Munsell system of ordering colors (Cleland T. M., 1937) are, by and large, common standards in linguistic research.

place in the theory. They suggested that the way to determine equivalent terms across languages was to ignore the extent to which exemplars overlapped, and to define equivalence by having common foci. Looked at in this way, they claimed that there were just eleven terms that accounted for the majority of terms in the 20 languages.

A further manoeuvre — identifying "basic color terms" (BCTs) — restricted the emerging theory to what they claimed were the "necessary" or "core" color terms of each language. Berlin and Kay (1969) defined BCTs according to the following criteria: (1) the term is monolexemic — that is, its meaning is not predictable from the meaning of its parts; hence not *light blue;* (2) Its significance is not included in that of other color terms; hence not *scarlet* which is included in *red*. (3) Its application must not be restricted to a narrow class of objects; hence, not blonde. (4) It must be psychologically salient for informants, as evidenced, for instance by having high frequency in elicited lists. However, Kay, Berlin, Maffi and Merrifield (1997) state that these criteria for basicness were more a set of guidelines than a formal definition and in practice, the criteria reduce to "simple and salient" (Hardin C. L. & Maffi L., 1997).

Following these two manoeuvres, it became apparent that there were strong constraints on what combinations of color terms occurred across the languages. Berlin and Kay expressed these regularities using the implicational hierarchy shown in Figure 2.

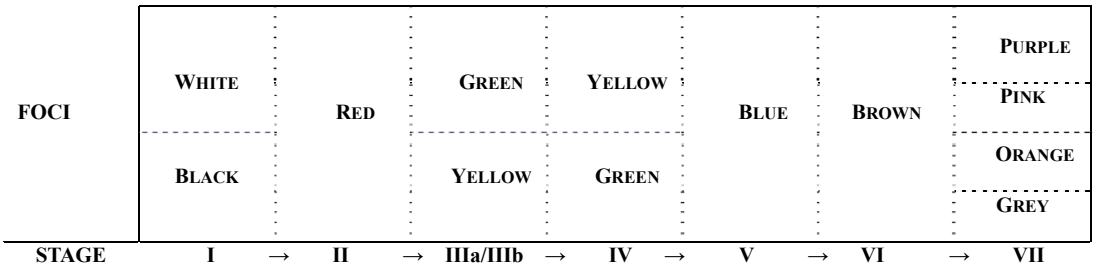


Figure 2 The Berlin and Kay's Hierarchy for Basic Color Terms

All languages appeared to have terms with prototypes for WHITE and BLACK, shown at the left of the hierarchy, but some languages had no other basic color terms. However, if a language had a term for any of the colors further right in the hierarchy, it always had terms for all the others to the left in the hierarchy. For example, if a language had a term with its prototype at GREEN, then it would also have terms with the prototypes at WHITE, BLACK, AND RED. If terms shared a place on the hierarchy, such as GREEN and YELLOW, then knowing a language had one of the terms implies nothing about whether the language should also have the other term.

As well as these synchronic constraints on "permissible" combinations of terms, Berlin and Kay also suggested that the hierarchy encapsulated diachronic constraints on the orders that languages acquired terms. As alluded to above, they proposed that all languages started with terms for BLACK and WHITE, then added a term for RED, then for either GREEN or YELLOW, and so on, up to the maximum of eleven BCTs.

1.2 Beyond the Eleven

Kay P. & McDaniel C. (1978) developed the Berlin and Kay (1969) theory using a system of fuzzy logic, consistent with the prototypical properties of natural categories (Rosch E., 1973), Rosch E. (1975), Kay P. & McDaniel C. (1978) proposed that six fundamental neural responses (FNRs) were directly responsible for the perception and linguistic structure of what they called the "primary" colors — namely, black, white, red, green, yellow, and blue. They drew a distinction between two types of non-primary color categories: composite and derived categories. Composite categories are the fuzzy union of two FNRs. For instance, it is common to have a

single term that includes both the universal categories BLUE and GREEN — "GRUE". Derived categories are the fuzzy intersection of two FNRs; so, for example, ORANGE is the fuzzy intersection of RED and YELLOW.

One implication of the Kay P., & McDaniel C. (1978) theory is that there are logically possible fuzzy unions and intersections that are not included in the Berlin and Kay (1969) hierarchy. For example, Zollinger H. (1984) argues that the space between blue and green is wide enough to be encoded by the term turquoise, derived from the fuzzy intersection of these two FNRs. Adding a blue term appears to be the most common way that languages move beyond the eleven Berlin and Kay basic color terms (stage seven). Russian, Davies I. R. L. & Corbett G. G. (1994), Turkish Özgen E. and Davies I. R. (1998) and Greek (Androulaki, Gômez-Pestaña, Mitsakis, Lillo, Coventry & Davies, 2006) all have 12 BCTs, encoding the blue region with two basic terms distinguishing between light and dark blue. The extra blue term could either be the fuzzy intersection of BLUE and BLACK, resulting in "dark blue", or the intersection of WHITE and BLUE, resulting in "light blue". Pilot work suggested that Arabic might have three terms that designate different kinds of blue: *azrock* "blue", *samawee* "light blue" and *khuhlie* "dark-blue". The majority of our informants sorted the blue stimuli into groups that they named *samawee* "light blue" and *azrock* "blue", suggesting that a more apt gloss for *azrock*may be "dark-blue".

1.3 Aims of the Current Set of Experiments

The overall aims of the present study were to determine the BCTs of Arabic and to explore the status of the putative extra blue terms. Two groups of Saudi Arabic speakers were tested: children 8 to 12 years old and adults 18 to 25 years old. Two methods were used: elicited lists and color naming. The status of the three blue terms *azrock* "blue", *samawee* "light blue" and *khuhlie* "dark blue" was of particular interest.

2. Experiment 1: Elicited Lists

2.1 Introduction

Participants were required to write down as many color terms as they could think of. As BCTs have high salience, they should be offered by the majority of informants, and we use frequency in the lists as one measure of basicness. The most salient terms should also tend to be among the earliest terms offered, and we use mean list position as a second measure of basicness.

2.2 Method

2.2.1 Participants

Two groups of Arabic speakers took part, the child group and the adult group. The child sample consisted of 113 boys and 140 girls, with an age of 8 to 12 years (mean = 10:6). They were drawn from three different primary schools in Riyadh and were tested in school. All of the participants were monolingual Arabic speakers. There were 200 informants in the adult group, half were men and half were women, with an age range of 18 to 25 years (mean = 19.83). They were students at King Saud University and they were all native Arabic speakers with some knowledge of English.

2.2.2 Procedure

For both samples, data was collected by a first language speaker of Arabic and instructions were given in Arabic. The child sample was tested in a group in a classrooms and the adult sample was tested in a group in lecture theatres or classrooms. Informants were given a sheet of paper, and were asked to write down all of the color terms they could think of. The child sample was told they had four minutes to complete the task, while the

adult sample was told they had one minute to complete the task.

2.3 Results

The terms offered by each group were examined in terms of the percentage of each sample that offered each term, and mean list positions. The glosses given are consistent with the Arabic-English Dictionary (1974), and with the color-naming experiment data that will be reported later.

2.3.1 Child Lists

The mean number of terms offered was 12.99, and the range was from 2 to 26. Forty three terms were offered by the boy sample (mean = 12, SD = 3), and 40 terms by the girl sample (mean = 13, SD = 4).

Frequency of use, Table 1 shows the terms offered by at least 10% of the child sample (column 1) ordered by frequency of use; their English gloss (column 2); and their frequency of use across the sample (column 3).. It can be seen that the most frequent terms were *ahmar*, "red", *azrock*, "blue", *akhdar*, "green", *asfer*, "yellow", *asswed*, "black" and *abiyadh*, "white". Each of these six terms was offered by at least 88.8% of the sample and they appear to be the Arabic tokens of the six universal primary categories. The terms *boartoogaalee*, "orange", *bonee*, "brown", *wardee*, "pink", *banafsagee*, "purple" were the next most frequent terms, each offered by almost 78% of the sample, and they appear to be the Arabic tokens of four of the universal derived terms. *Rassasee*, "grey" was the next most frequent term; it was offered by 63.3% of the sample. *Samawee* "light blue" and *khuhlie* "dark blue" scored 40% and 38.6% respectively at positions 12 and 13.

Mean list position, Mean list positions for each term are shown in Table 1 column 5. The first 13 terms according to frequency of use also occupy the first 13 positions in mean list position, although the two orders differ a little. *Samawee*, "light blue" and *khuhlie*, "dark blue" were at positions 12 and 13 according to both measures.

Table 1 Child List Task (N = 253): Terms Offered in the List Task by at Least 10% of the Child Sample, Their English Glosses, The Percentage of Respondents that Offered Each Term, and the Mean List Position

Term	Gloss	Percentage	Percentage order	Mean list position	Mean list position order
Ahmar	Red	98.8	01	02.41	01
Akhdar	Green	96.0	02	05.31	03
Asfer	Yellow	95.2	03	05.29	02
Azrock	Blue	92.8	04	05.95	04
Asswed	Black	90.0	05	07.95	05
Abiyadh	White	88.8	06	08.81	06
Bonee	Brown	82.5	08	10.32	07
Boartoogaalee	Orange	80.1	07	11.08	08
Wardee	Pink	76.1	09	12.39	10
Banafsagee	Purple	74.5	10	12.27	09
Rassasee	Grey	63.3	11	15.76	11
Samawee	Light blue	40.6	12	19.19	12
Khuhlie	Dark blue	38.6	13	19.55	13
Dahabee	Golden	34.3	14	19.96	14
Fadhee	Silver	31.9	15	20.63	15
Enaabee	Dark red	26.3	16	21.44	16
Beige	Beige	19.5	17	22.42	17
Zeatee	Oil-green	16.7	18	22.80	18
Tufahee	Apple	14.7	19	23.21	19
Sukaree	Sugar	12.0	20	23.58	20
Fosforee	Phosphoric	10.0	21	23.76	21

2.3.2 Adult list terms

The mean number of terms offered was 10.97, and the range was from 6 to 17. The number of terms offered by the male sample was 43 (mean = 11 SD = 2), and 38 terms by the female sample (mean = 11, SD = 3).

Table 2 shows the adult data laid out as for Table 1. The terms and their rank orders on both main measures are very similar to those from the child data. The first 13 terms are the same as those for the children, with minor variations in their rank order. *Ahmar,* "red", *akhdar*, "green", *asfer* "yellow" and *azrock* "blue" have the four highest scores, and the remaining Berlin and Kay BCTs occupy the next seven places. Note however, *rassasee*, "grey", was offered by less than half the sample (47.5%). *Samawee* "light blue" and *khuhlie* "dark blue" occupy ranks 12 and 13 on both measures, but they were offered less frequently (~ 10%) than by the children.

Table 2 Adult List Task (N = 200): Terms Offered in the List Task by at Least 10% of the Adult Sample, Their English Glosses, the Percentage of Respondents that Offered Each Term, and the Mean List Position

Term	Gloss	Percentage	Percentage order	Mean list position	Mean list position order
Ahmar	Red	99.0	01	02.26	01
Akhdar	Green	96.0	02	04.27	02
Asfer	Yellow	93.0	03	05.02	03
Azrock	Blue	90.0	04	05.42	04
Asswed	Black	89.5	05	07.05	05
Banafsagee	Purple	82.0	06	08.86	07
Abiyadh	White	81.0	07	08.18	06
Boartoogaalee	Orange	72.0	08	10.06	08
Bonee	Brown	70.0	09	10.83	09
Wardee	Pink	67.5	10	10.99	10
Rassasee	Grey	47.5	11	13.79	11
Samawee	Light blue	30.0	12	15.22	12
Khuhlie	Dark blue	27.5	13	15.56	13
Beige	Beige	18.5	14	16.52	15
Tarquazee	Turquoise	17.5	16	16.51	14
Dahabee	Golden	16.5	17	16.65	18
Zeatee	Oil-Green	16.0	15	16.67	16
Foshy	Fuchsia	16.0	18	16.64	17
Fadhee	Silver	13.0	19	17.06	19
Enaabee	Dark red	11.5	20	17.13	20
Tufahee	Apple	11.0	21	17.14	21

2.4 Discussion

Essentially the same patterns of scores were found across both samples and across both measures. The Arabic versions of the six universal primary categories: *asswed* "black", *abiyadh* "white", *ahmar* "red", *akhdar* "green", *asfer* "yellow" and *azrock* "blue" tended to be found among the first six or seven places on both measures, and they were each given by a clear majority of both samples. The five derived terms *bonee* "brown", *boartoogaalee* "orange", *wardee* "pink", *banafsagee* "purple", and *rassasee* "grey", tended to occupy the next five or six places, and with the exception of *rassasee* "grey", and they were all offered by about 75% of each sample or more. The score for *rassasee* "grey" was just less than 50% for the adults.

The blue terms of interest, *samawee*, "light blue" and *khuhlie* "dark blue" occupied the 12th and 13th positions for both groups on both measures. However, the majority of each group did not offer these terms: their scores were about 40% for the children and about 30% for the adults. The remaining terms were offered by a clear minority of each group, with the highest score being for *dahabee* "golden" at about 35% for the children.

3. Experiment 2: Color Naming

3.1 Introduction

Participants were required to name each of a set of 65 colors approximately evenly distributed across color space. This set has been used extensively in investigations of BCTs across a range of languages, starting with Setswana (Davies, MacDermid, Corbett, McGurk, Jerrett, Jerrett and Sowden, 1992) and most recently by Uusküla M. (2008) on Finno-Ugric and Slavonic languages. Data were examined in terms of various indicators of salience and consensus of use (the percentage usage for each of tile; frequency of use per term, "dominant" color term per color tile, and the "specificity" index). Basic terms should tend to have high scores across these indicators Davies I. R. L. & Corbett G. G. (1994; 1997), Özgen E. and Davies I. R. (1998).

Estimates of the prototypes for each Arabic BCT were also derived. If Arabic BCTs are tokens of Berlin & Kay's eleven universal categories, then the Arabic prototypes should be very similar to the universals. Similarity was assessed by comparing the location of Arabic and universal foci in the CIE (1976) uniform chromaticity diagram (see Appendix 1 for an outline of the CIE system).

3.2 Method

3.2.1 Participants

There were two groups of participants, children (aged 8–12 years) and adults (aged 18–28 years), drawn from the same sources as for Experiment 1. There were 60 in the adult group, half men and half women, and 61 children (31 boys and 30 girls). All were first language Arabic speakers, although some in the adult group knew a little English.

3.2.2 Stimuli

The stimuli were 65 colored "tiles", measuring 50 mm square and 4 mm thick. They were made of cardboard covered with colored paper selected from the Color-Aid Corporation range of colors so that they were a representative sample of the full range. Table A in the Appendix 1 shows the Color-Aid codes and the CIE chromaticity coordinates. Figure 3 shows the location of the tiles in the CIE (u' v') uniform chromaticity diagram, along with the loci of the 11 universal color foci Heider E. R. (1971) that can be used as "landmarks". As can be seen from the graph, the best example of blue is located at the bottom of the graph, moving through green in the upper left and out to red in the upper right. Yellow is located at the top-centre and achromatic colors (white, black and greys) are located at the centre of the graph. Stimuli were named under the natural day light.

3.2.3 Procedure

Participants were tested individually by an Arabic speaker and instructions were in Arabic. Male informants were tested by the author and female informants by a female lecturer from King Saud University. Participants first had their color vision tested and those who failed were excluded from the experiment. Males were tested with *Ishihara's Test for Color-Blindness* (Ishihara Shinobu M., 1987). Females were assessed by the *City University Colour Vision Test* (Fletcher R., 1980) as they tested in a separate building than males. Stimuli were presented one

at a time, in a different random order for each subject, until all 65 tiles had been presented. The instructions were to name each tile using a simple, every-day color term.

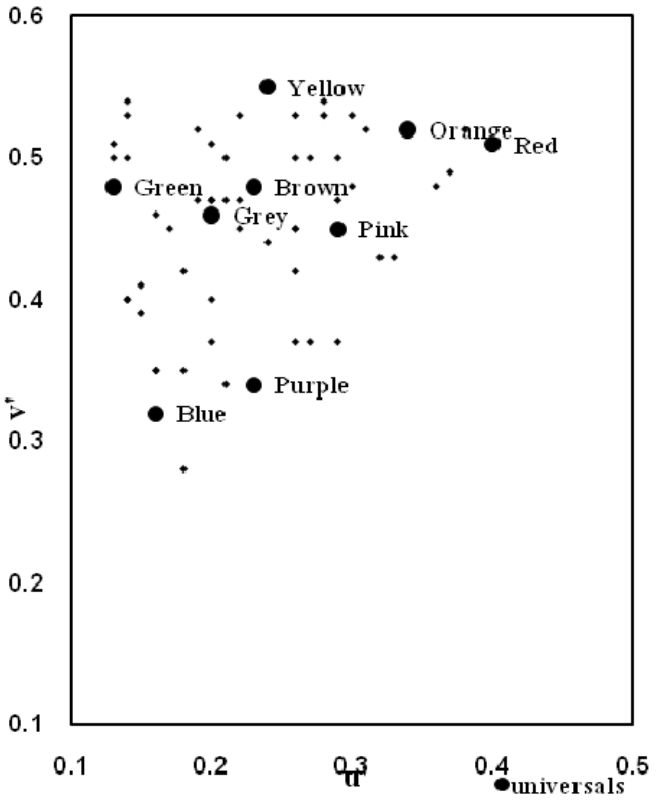


Figure 3 Location of the Chromatic Stimuli in CIE (1976) Color Space (u'v').

3.3 Results

For children, 33 color terms were used to describe the stimuli, in 3924 naming assignments out of a possible 3965 responses (61 participants × 65 tiles). Adults used 30 terms in 3831 responses out of a possible 3900 (60x65). Summaries of the most frequent terms used to name each tile are shown in Tables A and B in Appendix 2.

Here, to provide the basis for deciding which terms are basic, the pattern of usage across tiles is summarized in Tables 3 and 4 for children and adults respectively. Column 3 in both tables shows the percentage frequency of use for each of the terms collapsed across all tiles and all informants. The tables are ranked by the frequency of occurrence of the term starting with the most frequent term. For example, *akhdar* "green" was the most frequent term for both samples with a score 15.8% for children and 15.7% for adults. The Arabic versions of Berlin and Kay's BCTs: *asswed* "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey" occupy the first eleven positions in the frequency column for the child sample, but the primary basics and derived basics are intermingled. The Berlin and Kay terms tend to have the highest scores for the adults as well, except *abiyadh* "white" appears after *samawee* "light blue".

The second summary measure is the number of tiles for which a given term was the most frequent term across the sample (*nmf*). For instance, *akhdar* "green" was the most frequent term for 11 out of the 65 tiles for

children and for 13 tiles for adults. It can be seen that there are 13 terms that have *nmf* scores of one or greater; these are the Arabic versions of the Berlin and Kay universals plus *samawee* "light blue" and *zeatee* "oil green" both of which have scores of one for both samples.

The *nmf* is an index of consensus of use, but a relatively weak one. For example, a term can be the most frequent term even though it is not used by the majority of the respondents; e.g., see tile RVR Hue in Table A in the Appendix 2 where *banafsagee* "purple" was the most frequent even though it was only used by 31.1% of the sample. Columns 5–7 in Tables 3 and 4 show more stringent indices of consensus: the "Dominance" indices. A term is dominant for a particular tile if the proportion of the sample using it exceeds a given threshold. For instance, 11 tiles were named *akhdar* "green" by at least 50% of the child-sample and the D_{50} score for *akhdar* "green" is 11. Of these 11 tiles, 8 were named *akhdar* by at least 75% of the sample, and its D_{75} score is 8; finally of these 8 tiles, 7 were named *akhdar* "green" by 90% or more of the sample, and its D_{90} score is thus 7. It can be seen from Tables 3 and 4 (column 5) there were twelve terms that achieved dominance in both samples at the D_{50} criterion, the 11 BCTs, plus *zeatee* "oil green" in the children's results and *samawee* "light blue" in the adult sample; *zeatee* "oil green" and *samawee* "light blue" were dominant for only one tile each. The 11 Berlin and Kay terms each had at least one tile that achieved the D_{75} threshold, and these were the only terms to do so. Of the 11 Berlin and Kay terms, all also met the D_{90} criterion in the child–sample: except *wardee* "pink", and *banafsagee* "purple". In the adult sample, all the Berlin and Kay terms except *azrock* "blue" met the D_{90} threshold.

One problem with the dominance indices as measures of consensus, is that they are influenced by the distribution of colours in the set. For instance, the region of colour space labelled *akhdar* "green" is considerably larger than the region labelled *asfer* "yellow" and this is reflected in the dominance scores for the former being higher than for the latter. The final column (8) in Tables 3 and 4 shows a further measure of agreement, the "specificity index", which is independent of the overall frequency of use. This score reaches its maximum of 1 if the term is only used to name tiles with "high" consensus and reaches its minimum (0) if it is never used with high consensus. The consensus could be just for one tile or it could be based on many tiles. As the name suggests, it is an index of how precisely or specifically a terms was used. The version we use here is the ratio of the sum of its frequency of use for tiles that were dominant at D_{50} divided by its total frequency of use across all tiles. It can be seen that the terms that had non-zero scores in both samples were the Arabic tokens of the "universals" plus, *zeatee* "oil green" in the child-sample, which scored 0.31 and *samawee* "light blue", for adults with a score of 0.35. In both cases, the specificity index is much lower than the minimum score for a Berlin and Kay term (0.65).

Comparing the two samples, it can be seen that the overall level of consensus was higher for adults than for children: for adults, 56 tiles out of 65 had a dominant term at D_{50}; 38 at D_{75}; and 26 at D_{90}. For children the corresponding scores were: 55 at D_{50}, 33 at D_{75}, and 18 at D_{90}.

Location of colors with dominant terms in CIE u' v' Figures 4 and 5 show the location of all stimuli that met the D_{75} criterion and above in the CIE uniform chromaticity diagram. Eleven colour terms: *asswed* "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey" are shown in each diagram. The locations of the exemplars of the various terms are very similar. As can be seen, blue stimuli lie at the bottom of the graph, moving through green in the upper left and out to red in the upper right. Yellow is located at the top-centre and achromatic colors (white, black and greys) are located at the centre of the graph.

Table 3 Child Tile-Naming Summary (N = 61): Terms Used, Their English Glosses, The Percentage of Total Usage, the Number of Tiles for Which A Term Was the Most Frequent, and The Dominance and Specificity Indices

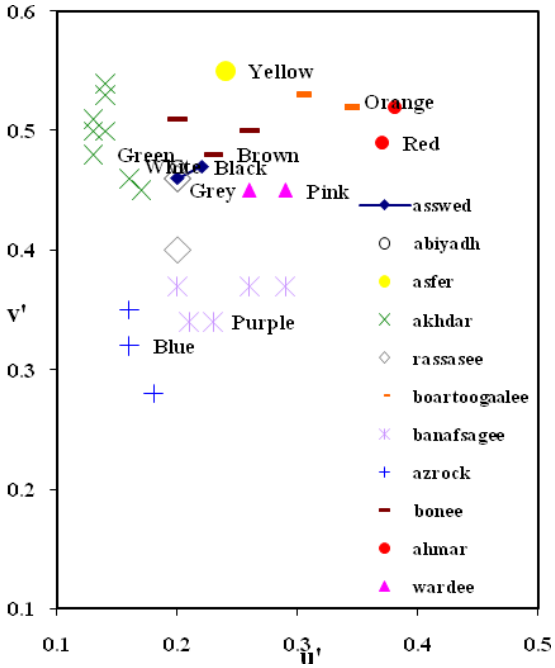
Term	Gloss	%	No. of tiles most frequent	No. of tiles dominant D_{50}	No. of tiles dominant D_{75}	No. of tiles dominant D_{90}	Specificity index S
Akhdar	Green	15.8	11	11	8	7	0.46
Azrock	Blue	11.3	9	6	4	1	0.32
Wardee	Pink	10.6	10	7	2	0	0.75
Banafsagee	Purple	9.5	7	5	4	0	0.32
Boartoogaalee	Orange	9.2	6	6	3	2	0.85
Bonee	Brown	7.4	5	5	3	2	0.80
Rassasee	Grey	6.2	4	4	3	1	0.79
Asfer	Yellow	5.3	4	4	1	1	0.85
Ahmar	Red	5.2	3	2	2	1	0.53
Asswed	Black	3.6	2	2	2	2	0.82
Abiyadh	White	2.9	2	2	1	1	0.89
Zeatee	Oil Green	2.7	2	1	0	0	0.31
Samawee	Light blue	2.5	1	0	0	0	0.00
Khuhlie	Dark blue	1.1	0	0	0	0	0.00
Beige	Beige	1.1	0	0	0	0	0.00
Lahmee	Meaty	1.0	0	0	0	0	0.00
Tarquazee	Turquoise	0.4	0	0	0	0	0.00
Fuoshee	Fuchsia	0.4	0	0	0	0	0.00
Enaabee	Dark red	0.4	0	0	0	0	0.00
Fadhee	Silver	0.3	0	0	0	0	0.00
Ashbee	Light green	0.3	0	0	0	0	0.00
Halibee	Cream	0.3	0	0	0	0	0.00
Dahabee	Golden	0.2	0	0	0	0	0.00
Ramalee	Sandy	0.2	0	0	0	0	0.00
Audee	Dark brown	0.2	0	0	0	0	0.00
Sukaree	Sugar	0.1	0	0	0	0	0.00
Fostoqee	Pistachio	0.1	0	0	0	0	0.00
Tufahee	Apple	0.1	0	0	0	0	0.00
Kamonee	Cumin	0.1	0	0	0	0	0.00
Basalee	Onion	0.0	0	0	0	0	0.00
Fosforee	Phosphoric	0.0	0	0	0	0	0.00
Kurbazee	No Gloss	0.3	0	0	0	0	0.00
Don't know		1.03	0	0	0	0	0.00

Table 4 Adult Tile-Naming Summary (N = 60): Term Used More than Once in the Tile-Naming Task by Adult: English Glosses, the Percentage of Total Usage (Over 0.05), the Number of Tiles for Which A Term Was the Most Frequent, and the Dominance and Specificity Indices

Term	Gloss	%	No. of tiles most frequent	No. of tiles dominant D_{50}	No. of tiles dominant D_{75}	No. of tiles dominant D_{90}	Specificity index S
Akhdar	Green	15.7	13	10	8	5	0.85
Wardee	Pink	10.67	7	7	4	3	0.81
Banafsagee	Purple	10.44	7	7	5	4	0.80
Boartoogaalee	Orange	9.54	7	6	4	2	0.78
Bonee	Brown	8.51	7	6	4	3	0.92
Azrock	Blue	7.90	6	5	3	0	0.69
Rassasee	Grey	6.30	4	4	4	4	0.93
Asfer	Yellow	5.18	4	4	2	1	0.91
Ahmar	Red	3.62	3	2	1	1	0.69
Asswed	Black	3.13	2	2	2	2	0.98
Samawee	Light blue	2.95	1	1	0	0	0.35
Abiyadh	White	2.72	2	2	1	1	0.97
Zeatee	Oil Green	2.38	1	0	0	0	0.00
Khuhlie	Dark blue	1.38	0	0	0	0	0.00
Fuoshee	Fuchsia	1.00	0	0	0	0	0.00
Tarquazee	Turquoise	0.87	0	0	0	0	0.00
Enaabee	Dark red	0.87	0	0	0	0	0.00
Kurbazee	No Gloss	0.82	0	0	0	0	0.00
Beige	Beige	0.67	0	0	0	0	0.00
Ashbee	Light green	0.46	0	0	0	0	0.00
Tufahee	Apple	0.38	0	0	0	0	0.00
Meshmeshee	Melon	0.26	0	0	0	0	0.00
Firozee	Turquoise	0.23	0	0	0	0	0.00
Fostoqee	Pistachio	0.18	0	0	0	0	0.00
Kamonee	Cumin	0.18	0	0	0	0	0.00
Shangaree	No Gloss	0.18	0	0	0	0	0.00
Batrwlee	Petrol	0.10	0	0	0	0	0.00
Halibee	Cream	0.08	0	0	0	0	0.00
Lahmee	Meaty	0.08	0	0	0	0	0.00
Basalee	Onion	0.08	0	0	0	0	0.00
Don't know		1.77	0	0	0	0	0.00

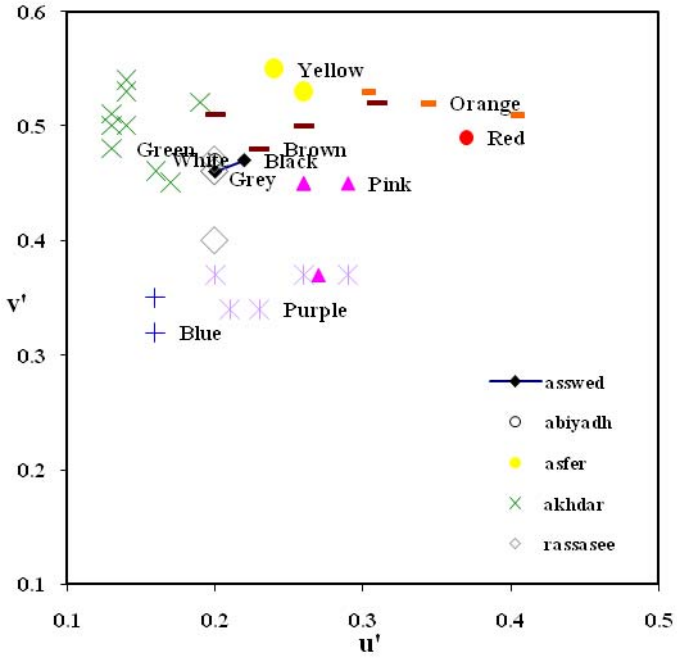
Location of Arabic "*focal* colors" the color chip with the highest frequency of use for each term was taken as an estimate of the category prototype or foci. In the few cases where no single tile had the highest score, the prototype was taken to be the mean (centroid) of the CIE coordinates of the tiles with joint highest scores. The tiles used to estimate the location of the prototypes are shown in Tables C and D in Appendix 2. Figures 6 and 7 show the location of the best example of the 11 Arabic BCTs in the CIE uniform chromaticity space in the two-axes (u' v') for child and adult samples. These Arabic foci were compared to the location of the loci of the 11

universal colour foci Heider E. R. (1971). It can be seen that for both samples the Arabic prototypes are close to the appropriate universal focus.



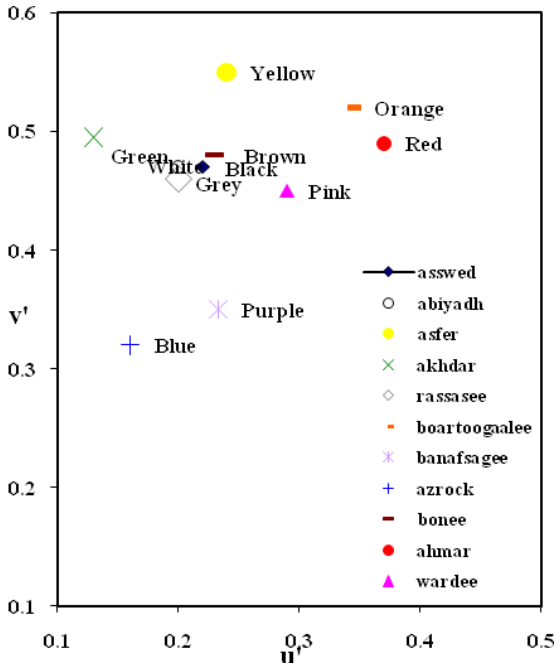
Asswed "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey".

Figure 4 Location of Stimuli Named with Agreement Level of 75% and Above in the CIE (1976) Chromaticity Diagram (u' v') for the Child Sample. Texts in the Figure Show the Location of the Loci of the 11 Universal Color Foci (Heider E. R., 1971).



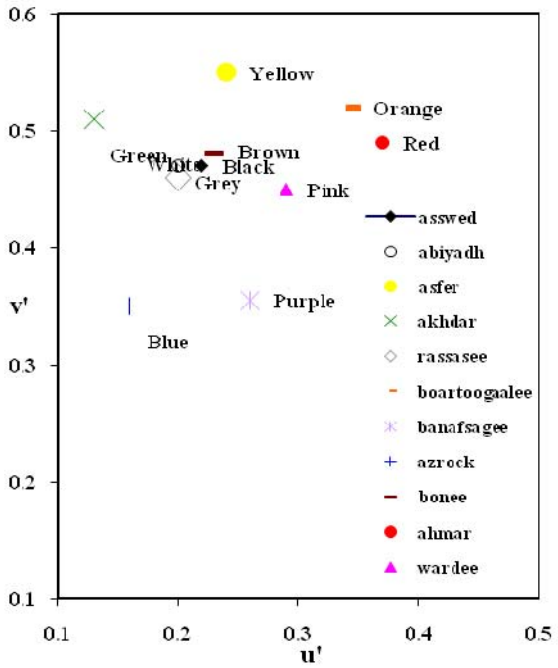
Asswed "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey".

Figure 5 Location of Stimuli Named with Agreement Level of 75% and Above in the CIE (1976) Chromaticity Diagram (U' V') for the Adult Sample. Texts in the Figure Show the Location of the Loci of the 11 Universal Color Foci (Heider E. R., 1971).



Asswed "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey".

Figure 6 Location of the 11 Best Example of the Arabic BCT which Have the Highest Agreement Level in the Color Naming in the CIE (1976) Chromaticity Diagram (u' v') for the Child Sample. Texts in the Figure Show the Location of the Loci of the 11 Universal Color Foci (Heider E. R., 1971).



Asswed "black", *abiyadh* "white" *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange" and *rassasee* "grey".

Figure 7 Location of the 11 Best Example of the Arabic BCT Which Have the Highest Agreement Level in the Color Naming in the CIE (1976) Chromaticity Diagram (u' v') for the Adult Sample. Texts in the Figure Show the Location of the Loci of the 11 Universal Color Foci (Heider E. R., 1971).

3.4 Discussion

The child and adult results for the naming task provide converging evidence that Arabic has eleven BCTs that are consistent with Berlin and Kay's universal colour categories: *asswed* "black", *abiyadh* "white", *ahmar* "red", *akhdar* "green", *asfer* "yellow", *azrock* "blue", *bonee* "brown", *banafsagee* "purple", *wardee* "pink", *boartoogaalee* "orange", and *rassasee* "grey". These are the same terms as suggested by the elicitation task. These terms have high frequency of use, are used with consensus as shown by the dominance scores, and their use is relatively constricted to regions of high agreement as shown by high specificity scores. Moreover, estimates of the category foci reveal that they are very similar to Berlin & Kay's universal foci. The term *zeatee* "oil green" had the 12th highest frequency of use for the child sample, and was the most frequent term for two tiles, and was dominant at 50% for one tile. However, its specificity index was low (0.31) and the twelve terms with higher frequency of use all achieved dominance at least 75%. The additional blue term, *samawee* "light blue" had the 12th highest frequency of use for the adults and 13th for children; it was the most frequent term for one tile for both samples, and was dominant for the same tile for the adult sample. However, it too had the lowest specificity index of all terms with a nonzero dominance index. *Azrock* "blue", the likely BCT for blue, had a low specificity score for the children, and it was the only primary BCT not to be dominant for at the 90% level for at least one tile for the adults. This may be due to *samawee* "light blue" sometimes being used as an alternative.

4. General Discussions

The results from the two experiments suggested that *ahmar* "red", *akhdar* "green", *asfer*, "yellow", *azrock* "blue", *asswed* "black", *abiyadh* "white", *banafsagee* "purple", *boartoogaalee* "orange", *bonee* "brown", *wardee* "pink" and *rassasee*, "grey" have the strongest claim to basic status. Arabic therefore corresponds perfectly with Berlin and Kay's stage VII of color term evolution. These 11 terms were the most frequently offered terms in the elicitation task with scores of almost 70% or more for both samples except for *rassasee*, "grey" which scored about 50% in both samples. The terms rank orders on both main measures were very similar with just minor variations in their positions. The tokens of the Kay and McDaniel's primary categories — *ahmar*, *akhdar*, *asfer*, *azrock*, *asswed*, and *abiyadh* were the six most frequent terms and they were offered by over 80% of the samples. *Banafsagee*, *boartoogaalee*, *bonee*, *wardee, and rassasee* were the next frequent terms and they are the Arabic derived categories.

All of the measures from the naming task also suggest that the eleven terms just given are probably BCTs in Arabic. They had high frequency of use, high dominance scores and high specificity indices. Although, *zeatee* "oil green", in the child results, and *samawee* "light blue", in the adult data were dominant at 50% for one tile, most other possible BCTs achieved higher dominance scores, the specificity scores (~ 0.30) were low. *Samawee* ("light blue") and *khuhlie* ("dark blue") may merit further investigation. For the current samples, they are probably not basic; exploring their status in older Arabic samples and in Arabic speakers from other regions could be interesting.

5. Conclusion

Arabic probably has eleven basic colour terms and these correspond with Berlin and Kay's eleven universal categories. The terms are that *ahmar* "red", *akhdar* "green", *asfer*, "yellow", *azrock* "blue", *asswed* "black", *abiyadh* "white", *banafsagee* "purple", *boartoogaalee* "orange", *bonee* "brown", *wardee* "pink" and *rassasee*.

Two probable secondary terms — and *samawee* "light blue", *zeatee* "oil green" had the next highest claim to being basic and may deserve further investigating.

References

Androulaki A., Gômez-Pestaña N., Mitsakis C., Lillo Jover J., Coventry K. and Davies I. R. L. (2006). *Basic Color Terms in Modern Greek: Twelve Terms.*

Berlin B. and Kay P. (1969). *Basic Color Terms: Their Universality and Evolution*, Berkeley & Los Angeles: University of California Press.

Cleland T. M. (1937). *A Practical Description of the Munsell Color System with Suggestions for Its Use*, Baltimore, MD: Munsell Color Co.

Davies I. R. L. and Corbett G. G. (1994). "The basic color terms of Russian", *Linguistics*, Vol. 32, pp. 63–89.

Davies I. R. L., MacDermid C., Corbett G. G., McGurk H., Jerrett D., Jerrett T. and Sowden P. (1992). "Color terms in Setswana: A Linguistic and perceptual approach", *Linguistics*, Vol. 30, No. 6, pp. 1065–1103.

Fletcher R. (1980). *The City University Color Vision Test*, Keeler Ltd. Windsor, Berks.

Hardin C. L. and Maffi L. (1997). "Introduction", in: Hardin C. L. & Maffi L. (Eds.), *Color Categories in Thought and Language*, Cambridge: Cambridge University Press.

Hering E. R. (1920/1964). *Outlines of a Theory of the Light Sense*, Translated by L. M. Hurvich & D. Jameson, Cambridge, MA: Harvard University Press.

Heider E. R. (1971). "'Focal'" color areas and the development of color names", *Developmental Psychology*, Vol. 4, No. 3, pp. 447–455.

Heider E. R. (1972). "Universals in color naming and memory", *Journal of Experimental Psychology*, Vol. 93, No. 1, pp. 10–20.

Ishihara Shinobu M. (1987). *Ishihara's Tests for Color-Blindness*, Tokyo: Kanehara & Co.

Kay P., Berlin B., Maffi L. and Merrifield W. (1997). "Color naming across languages", in: Hardin C. L. & Maffi L. (Eds.), *Color Categories in Thought and Language*, Cambridge: Cambridge University Press.

Kay P., Berlin B. and Merrifield W. (1991). "Biocultural implications of systems of color naming", *Journal of Linguistic Anthropology*, Vol. 1, pp. 12–25.

Kay P. and McDaniel C. (1978). "The linguistic significance of the meanings of basic color terms", *Language*, Vol. 54, pp. 610–646.

MacLaury R. E. (1987). "Color-category evolution and shuswap yellow-with-green", *American Anthropologist*, Vol. 89, pp. 107–124.

Mollon J. D. (1999). "Color vision: Opsins and options", *Proceeding of the National Academy of Sciences, USA*, Vol. 96, pp. 4743–4745.

Newhall S. M., Nickerson D. and Judd B. D. (1943). "Final report of the O.S.A. subcommittee on the spacing of the Munsell colors", *Journal of the Optical Society of American*, Vol. 33, No. 7, pp. 385–418.

Özgen E. and Davies I. R. (1998). "Turkish color terms: Test of Berlin and Kay's theory of color universals and linguistic relativity", *Linguistics*, Vol. 36, No. 5, pp. 919–956.

Pich J. and Davies I. (1999). "Color term acquisition in Spanish-Catalan children speakers", *Children and Learning*, Vol. 85, pp. 95–112.

Rosch E. (1973). "Natural categories", *Cognitive Psychology*, Vol. 4, pp. 328–350.

Rosch E. (1975). "The nature of mental codes for categories", *Journal of Experimental Psychology: Human Perception and Performance*, Vol. 1, No. 4, pp. 303–322.

Uusküla M. (2008). *Basic color terms in Finno-Ugric and Slavonic Languages: Myths and Facts*, Dissertationes Linguisticae Universitatis Tartuensis, 9, Tartu: Tartu University Press, p. 206.

Zollinger H. (1984). "Why just turquoise? Remarks on the evolution of color terms", *Psychological Research*, Vol. 46, pp. 403–409.

Appendix

Appendix 1 The Stimuli of Experiment Two

The Color-aid System

Color-aid Corporation produces the Color-aid system of colored papers. The full developed set contains the complete range of 314 matt-finished colors. The colors are divided into 34 hues, 100 tints, 47 shades, 114 pastels

and 17 greys from dark to light plus black and white. In the 220 Color-aid designs that we used in this study, there are six main Hues: Y (yellow), O (orange), R (red), V (violet), B (blue) and G (green). And three intermediate Hues for each main Hue, such as YOY (yellow, orange, yellow). Each of the 24 hues has four tints (T1-T4) with lightness increasing from T1 to T4, and three shades (S1-S3) with increasing blackness from S1 to S3. For more information, please see (www.coloraid.com).

The CIE (Committee International D'Eclairage)

In 1931 the CIE: Commission Internationale de l'Eclairage (International Commission on Illumination) produced the well-known color space that represents all possible colors in a chromaticity diagram. This model has been developed in several versions. One of them is the 1976 uniform chromaticity CIE (u'v') that was used in experiment two. This version is designed to be perceptually uniform. A given change in value corresponds nearly to the same perceptual difference over any part of the space. Table A. shows the Color-aid codes and CIE co-ordinates for the 65 tile colors.

Table A Color-Aid Codes and CIE Co-ordinates for the 65 Tile Colors

Color-aid code		CIE co-ordinates					
		Y	x	y	L*	u′	v′
Y	HUE	64.77	0.47	0.48	91.49	0.24	0.55
	S2	16.99	0.41	0.44	52.81	0.22	0.53
YOY	HUE	47.48	0.50	0.43	80.92	0.28	0.54
	T4	55.63	0.45	0.41	86.18	0.26	0.53
	S2	22.08	0.36	0.38	59.09	0.21	0.50
YO	HUE	39.52	0.51	0.41	75.17	0.30	0.53
	T3	47.02	0.48	0.41	80.61	0.28	0.53
	S3	10.72	0.36	0.41	43.02	0.20	0.51
OYO	HUE	26.51	0.54	0.37	63.81	0.34	0.52
O	HUE	25.00	0.54	0.37	62.26	0.34	0.52
	S1	14.34	0.50	0.37	49.03	0.31	0.52
	S3	09.15	0.42	0.36	39.98	0.26	0.50
ORO	HUE	18.87	0.57	0.34	55.26	0.38	0.52
	T3	36.88	0.46	0.35	73.09	0.29	0.50
	S3	26.51	0.33	0.32	63.81	0.21	0.47
RO	HUE	16.22	0.58	0.33	51.75	0.40	0.51
	T3	32.66	0.45	0.32	69.56	0.30	0.48
	S3	04.19	0.37	0.34	27.15	0.23	0.48
ROR	HUE	15.23	0.53	0.31	50.35	0.37	0.49
	T3	29.82	0.42	0.30	67.00	0.29	0.47
	S3	20.71	0.34	0.28	57.50	0.24	0.44
R	HUE	11.71	0.50	0.29	44.78	0.36	0.48
	T4	24.34	0.40	0.27	61.57	0.29	0.45
	S3	04.81	0.33	0.30	29.18	0.22	0.45

(To be continued)

(Continued)

Colour-aid code		CIE co-ordinates					
		Y	x	y	L*	u′	v′
RVR	**HUE**	09.11	0.42	0.24	39.90	0.33	0.43
	S1	12.79	0.35	0.25	46.60	0.26	0.42
	S3	28.43	0.36	0.28	65.69	0.26	0.45
RV	**HUE**	06.97	0.33	0.19	35.13	0.29	0.37
	T2	14.51	0.31	0.19	49.28	0.27	0.37
VRV	**HUE**	06.71	0.30	0.19	34.48	0.26	0.37
	S3	08.42	0.36	0.28	65.68	0.26	0.45
V-	**HUE**	04.67	0.26	0.17	28.74	0.23	0.34
VBV	**HUE**	04.13	0.24	0.17	26.94	0.21	0.34
	T4	19.05	0.25	0.20	55.49	0.20	0.37
BV	**HUE**	04.21	0.22	0.19	27.22	0.18	0.35
	S2	07.88	0.25	0.26	37.26	0.18	0.42
BVB	**HUE**	04.80	0.19	0.13	29.15	0.18	0.28
	S3	26.65	0.26	0.23	63.95	0.20	0.40
B	**HUE**	09.51	0.18	0.16	40.71	0.16	0.32
	T1	19.02	0.20	0.19	55.45	0.16	0.35
BGB	**HUE**	09.62	0.19	0.19	40.93	0.16	0.35
	T3	23.08	0.20	0.23	60.21	0.15	0.39
BG	**HUE**	08.93	0.20	0.25	39.53	0.14	0.40
	T1	16.57	0.19	0.25	52.24	0.14	0.40
	S2	07.42	0.21	0.26	36.21	0.15	0.41
GBG	**HUE**	10.69	0.23	0.37	42.96	0.13	0.48
	S2	20.79	0.20	0.25	57.60	0.14	0.40
G	**HUE**	11.99	0.24	0.42	45.26	0.13	0.50
	S3	06.10	0.26	0.33	32.91	0.16	0.46
GYG	**HUE**	12.89	0.25	0.44	46.76	0.13	0.51
	T4	31.14	0.26	0.41	68.21	0.14	0.50
	S1	15.59	0.26	0.31	50.86	0.17	0.45
YG	**HUE**	14.66	0.28	0.48	49.51	0.14	0.53
	S3	05.78	0.30	0.34	32.04	0.19	0.47
YGY	**HUE**	18.92	0.30	0.51	55.32	0.14	0.54
YGY	**S3**	35.87	0.35	0.43	72.27	0.19	0.52
ROSE RED		17.63	0.41	0.24	53.66	0.32	0.43
SIENNA		13.31	0.44	0.36	47.43	0.27	0.50
WHITE		81.40	0.32	0.33	100.00	0.20	0.47
GRAY 1		47.55	0.32	0.33	80.97	0.20	0.47
GRAY 2		30.59	0.32	0.33	67.71	0.20	0.47
GRAY 4		18.88	0.31	0.31	55.27	0.20	0.46
GRAY 6		11.20	0.31	0.31	43.89	0.20	0.46
GRAY 8		04.53	0.31	0.32	28.89	0.20	0.46
BLACK		03.59	0.34	0.33	24.98	0.22	0.47

Appendix 2 Detailed Results of the Color-Naming Task

Table A Child Tile-Naming Summary (N = 61). Terms Used To Name Each Tile With A Frequency of Use of at Least 10% of the Sample. (Code = Color-aid Code, % = Percentage of Respondents Who Used A Term for A Given Tile).

Code	Terms	%	Code	Terms	%	Code	Terms	%
Y-HUE	Yellow	100.00	Y-S2	Oil green	55.7			
				Brown	27.9			
YOY-HUE	Yellow	70.5	YOY-T4	Yellow	60.7	YOY-S2	Oil green	39.9
	Orange	24.6		Beige	18.0		Green	14.8
							Brown	14.8
YO-HUE	Orange	78.7	YO-T3	Yellow	59.0	YO-S3	Brown	75.4
	Yellow	18.0		Orange	19.7		Oil green	14.8
OYO-HUE	Orange	98.4						
O-HUE	Orange	98.4	O-S1	Orange	54.1	O-S3	Brown	95.1
				Brown	36.1			
ORO-HUE	Red	78.7	ORO-T3	Pink	37.7	ORO-S3	Orange	62.3
	Orange	21.3		Meat	21.3		Beige	14.8
RO-HUE	Orange	60.7	RO-T3	Orange	55.7	RO-S3	Brown	91.8
	Red	37.7		Pink	27.9			
ROR-HUE	Red	100.0	ROR-T3	Pink	67.2	ROR-S3	Pink	59.0
							Grey	14.8
R-HUE	Pink	49.2	R-T4	Pink	85.2	R-S3	Brown	63.9
	Red	36.1					Black	32.8
RVR-HUE	Purple	31.1	RVR-S1	Purple	41.0	RVR-S3	Pink	63.9
	Pink	21.3		Pink	41.0		Purple	19.7
	Red	18.0						
	D red	18.0						
RV-HUE	Purple	75.4	RV-T2	Pink	70.5			
				Purple	24.6			
VRV-HUE	Purple	80.3	VRV-S3	Pink	82.0			
	Blue	16.4						
V-HUE	Purple	80.3						
	Blue	16.4						
VBV-HUE	Purple	80.3	VBV-T4	Purple	77.0			
	Blue	18.0		Pink	11.5			
BV-HUE	Blue	63.9	BV-S2	Blue	42.6			
	Dblue.6	24.6		Purple	31.1			
				D blue	24.6			
BVB-HUE	Blue	83.6	BVB-S3	Grey	77.0			
B-HUE	Blue	90.2	B-T1	Blue	85.2			
				L blue	13.1			
BGB-HUE	Blue	82.0	BGB-T3	Blue	49.2			
	L blue	14.8		L blue	44.3			
BG-HUE	Blue	70.5	BG-T1	L blue	49.2	BG-S2	Green	70.5

(To be continued)

(Continued)

	Green	16.4		Blue	34.4		Blue	21.3
				Green	34.4			
GBG-HUE	Green	100.00	GBG-S2	Blue	42.6			
				L blue	23.0			
G-HUE	Green	98.4	G-S3	Green	91.8			
GYG-HUE	Green	100.00	GYG-T4	Green	83.6	GYG-S1	Green	93.4
YG-HUE	Green	93.4	YG-S3	Green	54.1			
				Oil green	44.3			
YGY-HUE	Green	95.1	YGY-S3	Green	72.1			
ROSE RED	Pink	59.0	SIENNA	Brown	55.7	WHITE	White	100.00
	Purple	19.7		Orange	26.2			
GRAY 1	White	68.9	GRAY 2	Grey	73.8	GRAY 4	Grey	91.8
	Grey	31.1						
GRAY 6	Grey	88.5	GRAY 8	Grey	91.8	Black	Black	

Table B Adult Tile-Naming Summary (N = 60): Terms Used to Name Each Tile with A Frequency of Use of at Least 10% of the Sample. (Code = Color-aid Code, % = Percentage of Respondents Who Used A Term for A Given Tile.)

Code	Terms	%	Code	Terms	%	Code	Terms	%
Y-HUE	Yellow	100.00	Y-S2	Oil green	48.3			
				Green	25.0			
YOY-HUE	Yellow	60.0	YOY-T4	Yellow	78.3	YOY-S2	Green	40.0
	Orange	33.3		Beige	11.7		Oil green	28.3
YO-HUE	Orange	83.3	YO-T3	Yellow	66.7	YO-S3	Brown	83.3
	Yellow	15.5	Beige	13.3				
			Orange	11.7				
OYO-HUE	Orange	100.00						
O-HUE	Orange	100.00	O-S1	Brown	61.7	O-S3	Brown	100.00
				Orange	33.3			
ORO-HUE	Red	63.3	ORO-T3	Brown	26.7	ORO-S3	Orange	53.3
	Orange	35.0		Pink	21.7		Yellow	15.0
				Beige	20.0		Kurbazee	11.7
				Kurbazee	11.7			
RO-HUE	Orange	88.3	RO-T3	Orange	56.7	RO-S3	Brown	100.00
	Red	10.0		Pink	15.0			
				Kurbazee	15.0			
ROR-HUE	Red	98.3	ROR-T3	Orange	40.0	ROR-S3	Pink	70.0
				Pink	33.3			
R-HUE	Red	48.3	R-T4	Pink	96.7	R-S3	Brown	90.0
	Pink	25.0						
	Fuoshee	23.3						
RVR-HUE	D red	48.3	RVR-S1	Pink	63.3	RVR-S3	Pink	93.3
	Pink	20.0		Purple	23.3			

(To be continued)

(Continued)

Code	Terms	%	Code	Terms	%	Code	Terms	%
RV-HUE	Purple	100.00	RV-T2	Pink	78.3			
VRV-HUE	Purple	98.3	VRV-S3	Pink	90.0			
V-HUE	Purple	100.00						
VBV-HUE	Purple	95.0	VBV-T4	Purple	81.7			
BV-HUE	Purple	41.7	BV-S2	Purple	65.0			
	D Blue	28.3		D Blue	23.3			
	Blue	25.0						
BVB-HUE	Blue	51.7	BVB-S3	Grey	91.7			
	Purple	28.3						
	D blue	20.0						
B-HUE	Blue	76.7	B-T1	Blue	80.0			
	L blue	20.0		L blue	20.0			
BGB-HUE	Blue	81.7	BGB-T3	L blue	66.7			
	L blue	13.3		Blue	33.3			
BG-HUE	Blue	61.7	BG-T1	Blue	41.7	BG-S2	Green	40.0
	Turquoise	15.0		L Blue	26.7		Blue	26.7
				Tarquazee	20.0			
GBG-HUE	Green	88.3	GBG-S2	Green	40.0			
				L blue	30.0			
				Blue	16.0			
G-HUE	Green	96.7	G-S3	Green	75.0			
				Oil green	20.0			
GYG-HUE	Green	100.00	GYG-T4	Green	80.0	GYG-S1	Green	96.7
YG-HUE	Green	96.7	YG-S3	Green	55.0			
				Oil green	33.3			
YGY-HUE	Green	96.7	YGY-S3	Green	81.7			
ROSE RED	Pink	73.3	SIENNA	Brown	71.7	WHITE	White	100.00
	Fuoshee	21.7		Orange	23.3			
GRAY 1	White	71.7	GRAY 2	Grey	93.3	GRAY 4	Grey	100.00
	Grey	26.7						
GRAY 6	GRAY	98.3	GRAY 8	Black	98.3	Black	Black	100.00

Table C Child Highest Percentage of Tile-Naming: Color-aid Codes, Terms Used, Their English Glosses, the Percentage of Highest Total Usage, the Average CIE Co-Ordinates for the 11 Basic Color Terms Along with the Loci of the 11 Universal Color Foci (Heider E. R., 1971)

Colour-aid Code			Term	Gloss	%	Average CIE co-ordinates	
1	2	3				u'	v'
WHITE	-	-	Abiyadh	White	100.00	0.20	0.47
BLACK	-	-	Asswed	Black	100.00	0.22	0.47
ROR-HUE	-	-	Ahmar	Red	100.00	0.37	0.49
GBG-HUE	GYG-HUE	-	Akhdar	Green	100.00	0.13	0.49
Y-HUE	-	-	Asfer	Yellow	100.00	0.24	0.55
O-HUE	-	-	Boartoogaalee	Orange	098.40	0.34	0.52
RO-S3	-	-	Bonee	Brown	091.80	0.23	0.48
GRAY 4	GRAY 8	-	Rassasee	Grey	091.80	0.20	0.46
B-HUE	-	-	Azrock	Blue	090.20	0.16	0.32
R-T4	-	-	Wardee	Pink	085.20	0.29	0.45
VRV-HUE	V-HUE	VBV-HUE	Banafsagee	Purple	080.30	0.23	0.35

Table D Adult Highest Percentage of Tile-Naming: Color-aid Codes, Terms Used, Their English Glosses, the Percentage of Highest Total Usage, and the Average CIE Co-ordinates for the 11 Basic Color Terms

Colour-aid Code			Term	Gloss	%	Average CIE co-ordinates	
1	2	3				u'	v'
WHITE	-	-	Abiyadh	White	100.00	0.20	0.47
BLACK	-	-	Asswed	Black	100.00	0.22	0.47
GYG-HUE	-	-	Akhdar	Green	100.00	0.13	0.51
Y-HUE	-	-	Asfer	Yellow	100.00	0.24	0.55
OYO-HUE	O-HUE	-	Boartoogaalee	Orange	100.00	0.34	0.52
RO-S3	-	-	Bonee	Brown	100.00	0.23	0.48
RV-HUE	V-HUE	-	Banafsagee	Purple	100.00	0.26	0.35
ROR-HUE	-	-	Ahmar	Red	098.30	0.37	0.49
R-T4	-	-	Wardee	Pink	096.70	0.29	0.45
GRAY 8	-		Rassasee	Grey	091.80	0.20	0.46
B-T1	-	-	Azrock	Blue	080.00	0.16	0.35