Trends in Synesthetically Colored Graphemes and Phonemes -- 2004 revision

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ABSTRACT: Debate has persisted for over 150 years as to whether there are specific patterns in synesthetically colored graphemes (letters) and phonemes (speech sounds).I investigate 255 colored-grapheme synesthetes, both from literature dating back 130 years ago to present, and from current personal correspondences, then compile and tabulate the data.I do the same for 29 colored phoneme synesthetes.Results indicate that certain graphemes and phonemes have very noticeable tendencies towards a specific color amongst synesthetes; furthermore, certain graphemes overlap with their corresponding phonemes as to color tendency.Colored phoneme trends also share similarities with worldwide sound symbolism trends.

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1. Introduction

One of the most common debates regarding synesthesia, easily traceable on back over 150 years, and, in certain ways, traceable back 2000 years or more, is that of whether or not all synesthetes have the same secondary sensation, or “correspondence” to a specific initial stimuli.In simpler words, do or do not all synesthetes who, for example, see letters and/or hear music as colored see the character “A” and/or hear the sound of a trumpet as red?Or, stated another way, as per earlier (2000 year old?) philosophies, is there something, for example, inherent in the written symbol “A” or the sound of a trumpet such that it will make all people who see its color see the color red?

Well, approached one way, this question is simple to handle:Just collect correspondence sets from synesthetes.As soon as you find anything that doesn't match, you know that synesthetes do not all have the same correspondences throughout for all items.

Unfortunately, in most all of such studies, upon finding the first discrepancy -- usually it took no more than two synesthetes' data sets -- the whole issue was then dropped with the claim that all synesthetes are uniquely individual.Thus, rarely was the question addressed as to what percentage of synesthetes saw a given specific color corresponding to a specific item, whether that percentage was within reason or a statistical anomaly, and whether the anomalies might be significant enough to shed light on some of the dark mysteries of what synesthesia is and how it works.

The prominent linguist, Roman Jakobson, wrote:

“[T]he cases of marked colored hearing, especially in or handed down from childhood, by those to whom acoustic impressions and especially speech sounds ‘arise unwillingly, regularly, and consistently with the same associated color experiences', show the close connection of the vowels *o* and *u* with the specifically darker colors, and *e* and *i*, in comparison, with the specifically brighter colors.Likewise, there is a distinct inclination for the more colored vowels to be with the more colorful colors, especially a tied together with red, and, contrariwise, the vowels *u* and *i* with the weakest tinted colors or even with the black-white range.Cases are known to us where only the darker vowels (for example, with a Swedish twelve-year-old girl, only '*u, o, å'*) arouse colors; generally the classifications to the dark vowels are apparently of more force and firmer than those to the bright, and, again, the classifications to the 'U-I range' firmer than that of the 'A range'" (Jakobson 1962: 386-387) [my translation from the German].

Jakobson adds in a footnote:

"... a cautious study of synesthetic associations between phonemic features and color attributes should yield clues to the perceptual aspect of speech sounds.There seems to be a phenomenal affinity between optimal chromaticity (pure red) and vocalic compactness, attenuated chromaticity (yellow--blue) and vocalic diffuseness, optimal achromaticity (black--white) and consonant diffuseness, attenuated achromaticity (grayed) and consonantal compactness; and, finally, between the value axis of colors (dark--light) and the tonality axis in language" (Jakobson 1962: 448) (original in English).

Granting that the data is extremely sparse, I nevertheless feel that, especially with the vowels, studies by Jakobson (1962), Cytowic (1989), Wheeler (1920), and others hint towards universals in regards to neurologic synesthetic associations.[i] tends to be white/yellow/bright, as does [e] (but not as bright as [i]), [o] tends to be black and/or white. [e] is often seen synesthetically as yellow, [a] is often seen as red.

Yet Brown writes:

"... phonetic symbolisms ought not to be assimilated to synesthesia for the reason that studies of synesthesia have typically yielded large individual differences.If there are intersensory connections which are responsible for phonetic symbolism these must be common to mankind generally.One can postulate the existence of such innate connections but there is little one can offer in proof of them.

"Universal intersensory connections of the sort to account for phonetic symbolism need not be innate.They could be learned from correlations of sense data that exist in the non-linguistic world to which all men are exposed ..." (Brown 1958: 132).

I disagree.Studies of synesthesia indicate great variation between individuals, but there do still appear to be a handful of things, such as colored vowels, which show trends.These trends can be sought for and, if found, documented, cross-linguistically.The question of innate or learned might be resolved not by linguistic analysis but by various neurological tests.

Unlike most other researchers, Marks (1978: 86-89) proposes relationships between specific vowel phones and specific colors.However, in agreement with most others, Marks' paradigm also has the factor of "high" vowels being brighter/whiter, and low vowels being darker/blacker.Marks orders vowels, from darkest to brightest, as follows: /u/, /o/, /a/, /e/, /i/.

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2. Colored Graphemes

Kay (1975) established a paradigm for the order in which basic color terms are added into a language (see also Berlin and Kay (1969)):

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WHITE\              /GRUE  > yellow\      |green|           |grey
          >RED<                      >    |and|   > brown > |orange
BLACK/              \yellow > GRUE/       |blue|            |pink
                                                            |purple
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Paraphrasing Brown (1991: 13-14) and Kay (1975), if a language has only two colors -- and all languages have at least two -- they are always “WHITE”, “which includes white, very light shades of all colors, all warm colors, and may have its focus in either white, red, or pink” (Kay 1975: 260), and “BLACK”, “which includes black, some very dark browns and purples, all but the lightest blues and greens, and which probably had variable focus in black and in dark greens and blues (ibid.).If a language has three colors, the one added is “RED”, which separates out all warm colors with the focus in English focal red.If a fourth is added, it will be either “GRUE”, which has a focus in blue or in green or perhaps in both, but which is not necessarily “blue-green”, or “yellow”.When the fifth is added, the language will then include both GRUE and yellow.The next stage will separate out and distinguish between “green” and “blue”.After this, “brown” is added.And, if an eighth or more terms are added, it or they will be “purple”, “pink”, “orange”, or “gray”.

Of course, it is known that Berlin and Kay's (1969) model and Kay's updated (1975) schema do not hold true for all cultures and their sets.The Japanese, for example, appear to have gotten “purple” into their scheme far before some other colors; and fine distinctions in browns, yellows and oranges came to the Nuer and the Irish (as reflected in descriptions of cattle) before any great emphasis between blue and green.Nevertheless, Berlin and Kay's model still remains a handy and useful tool if regarded as a general trend from which to base things.

The most common form of cognitive/categorizational synesthesia is colored letters and numbers, in which the synesthete will see, about a foot or two before her (the majority of synesthetes are female), different colors for different spoken vowel and consonant sounds, or perceive numbers and letters, whether conceptualized or before her in print, as colored.For example, a friend of mine, Deborah, always perceives the letter “a” as pink, “b” as blue, and “c” as green.

The writer Vladimir Nabokov had this form of synesthesia.His mother did also, but her colors for each letter were different than Vladimir's; in addition, Nabokov's mother also perceived music as colored.

“The confessions of a synesthete must sound tedious and pretentious to those who are protected from such leakings and drafts by more solid walls than mine are.To my mother, though, this all seemed quite normal.The matter came up, one day in my seventh year, as I was using a heap of old alphabet blocks to build a tower.I casually remarked to her that their colors were all wrong.We discovered then that some of her letters had the same tint as mine and that, besides, she was often optically affected by musical notes.These evoked no chromatisms in me whatsoever” (Nabokov 1966: 35).

Nabokov's wife Véra, it turns out, was also a synesthete, as was their son Dmitri, giving once again evidence of a genetic factor involved.Vladimir Nabokov reported having colored Cyrillic characters, too.Apparently, the famous Russian psychoanalyst Aleksandr Luria's patient Solomon Shereshevsky (“S”; the title character in Peter Brook and Marie-Helene Estienne's play “Je Suis un Phenomene” (“I Am a Phenomenon”) is this same Shereshevsky) also had colored Cyrillic letters (Luria 1968), as did Henri's (1893) friend Mlle. “X”

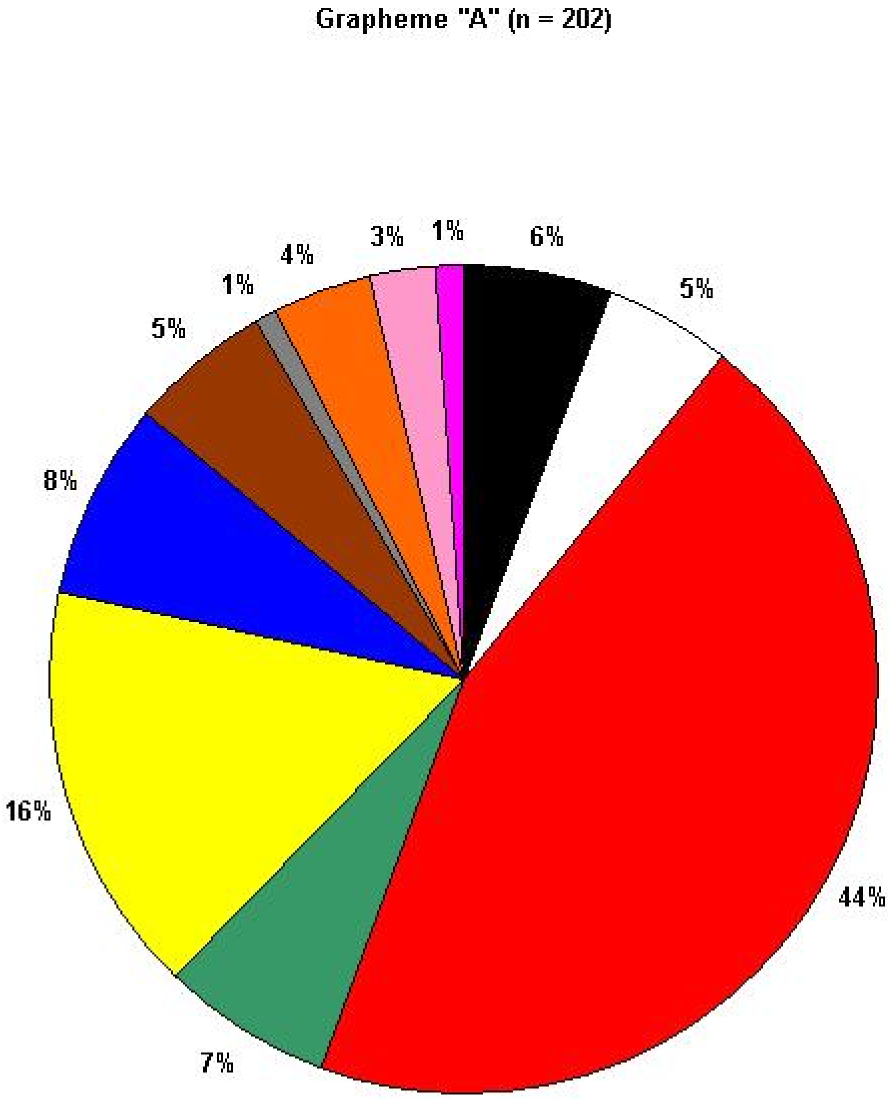
A “normal” plot for colored letters (either graphemes or phonemes), following along Berlin and Kay's (1969) paradigm of eleven colors, would flow between two interacting patterns.First, if all eleven colors are available to be chosen from, distribution should be even between them, with each color accounting for about 9.1% of the total.This, however, would work against the second factor, which Berlin and Kay pointed out, whereby certain colors in the paradigm are more likely to be filled in before others, in the order of black/white first, then red, green/yellow/blue, brown, and finally, gray/orange/pink/purple.Thus, there should be somewhat heavier weighing towards the black/white end of the ordering, and one would expect fewer than 9% for individual colors at the gray/orange/pink/purple end of the scale.

I have conducted my own research into synesthetically colored letters.The following data come from looking at the statements of 255 separate synesthetes, some found in articles stretching back as far as 1891; others, as of yet unpublished, from some of my current friends and colleagues.

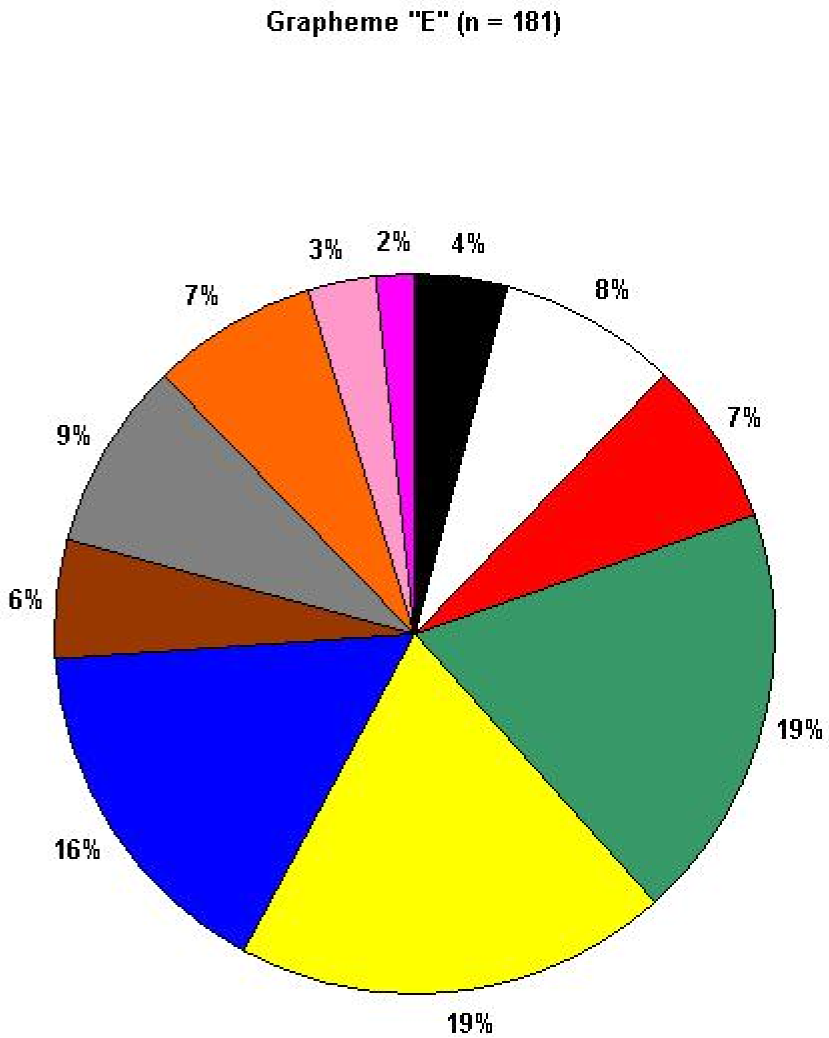
Of those who do see letters as colored, some synesthetes report more than one color for a given letter (the letter might, for example, be red with a black border, or green with a yellow stripe).When this occurs, if only two colors are given, I record both colors as 50%.If more than two colors are mentioned, I do not record anything for the given letter.Also, it is not at all uncommon for this type of synesthete to not have the entire alphabet colored; for example, only vowels may be colored, or perhaps only about 17 of the 26 letters.

My research on synesthetically colored graphemes (the written symbols, as opposed to the spoken sounds) so far has mainly dealt with western Indo-European languages and variances upon the Roman alphabet.This work has only recently begun to cover instances of Cyrillic script and Greek; I have also begun investigating colored Japanese kana, Chinese characters, and other writing systems.

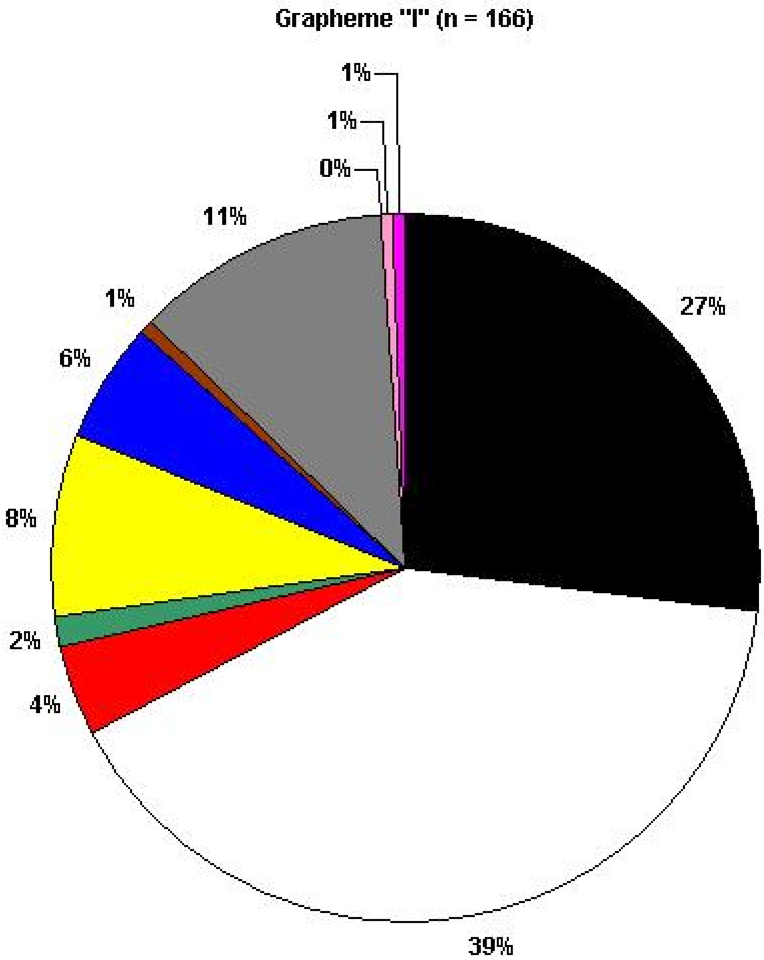
My research on Roman graphemes used by native Germanic and Romance language speaking synesthetes to denote vowels indicates that, for 202 synesthetes, “A” tends to be red more than any other color, about 44% of the time.Yellow is also highly represented, at 16%.



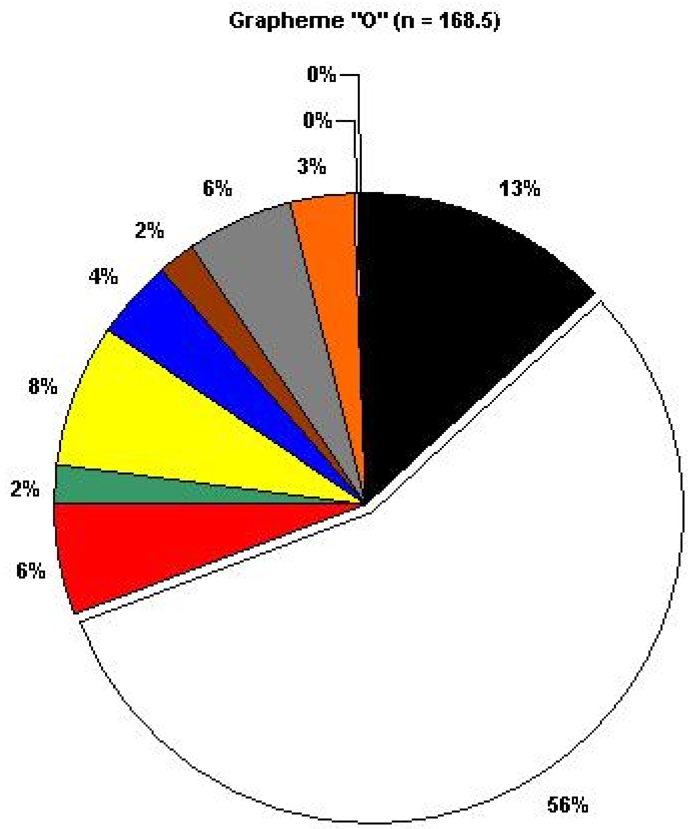
For 181 synesthetes, “E” tends to be green or bright yellow equally (19% for each), but blue is close behind.There does not seem to be any one color that predominates.



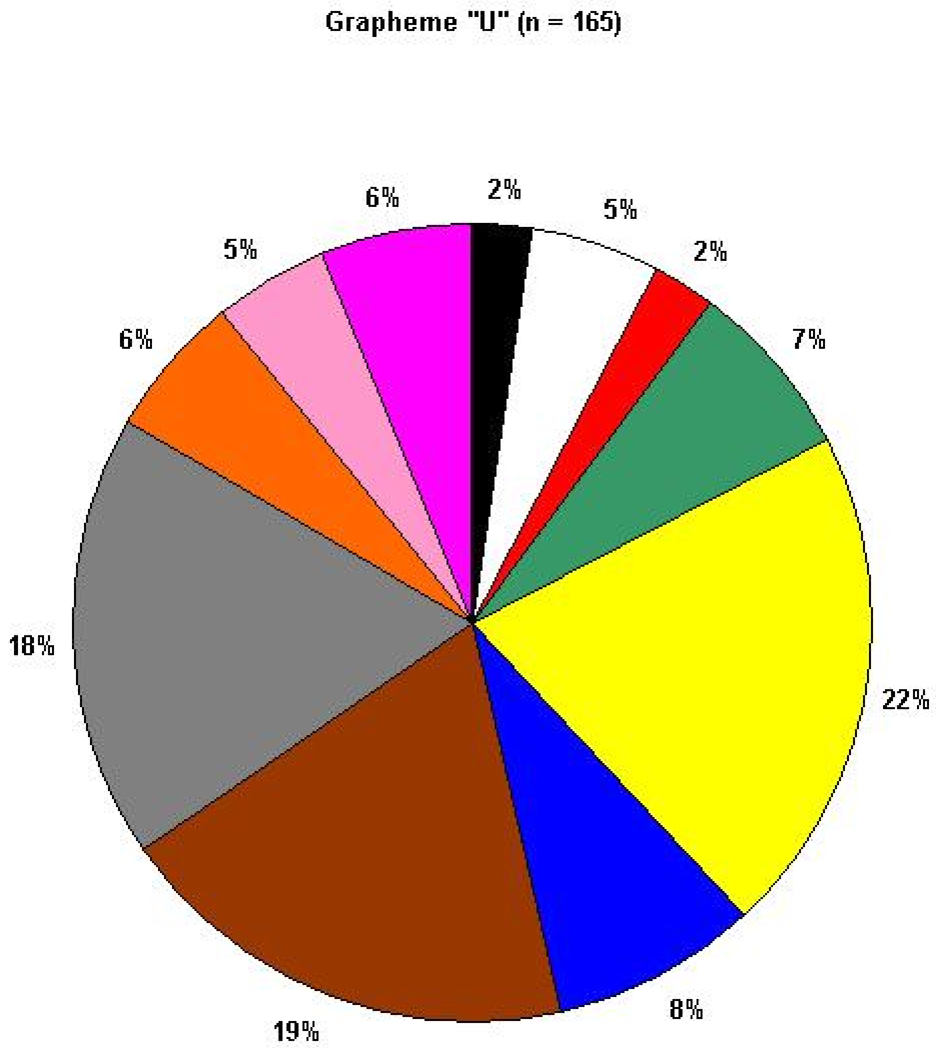
For 166 synesthetes, “I” has a strong tendency to be either white (39%), black (about 27%), or gray (11%) -- all in all, that is 77% uncolored.



For 168.5 synesthetes (one synesthete reported that half of the synesthetic perception is “clear” or “misty”), “O” has an overwhelming tendency to be white (56%); many synesthetes who have white O's explain that there is a connection with the empty space inside the circle, which is white when printed in the standard style of black ink upon a white page.

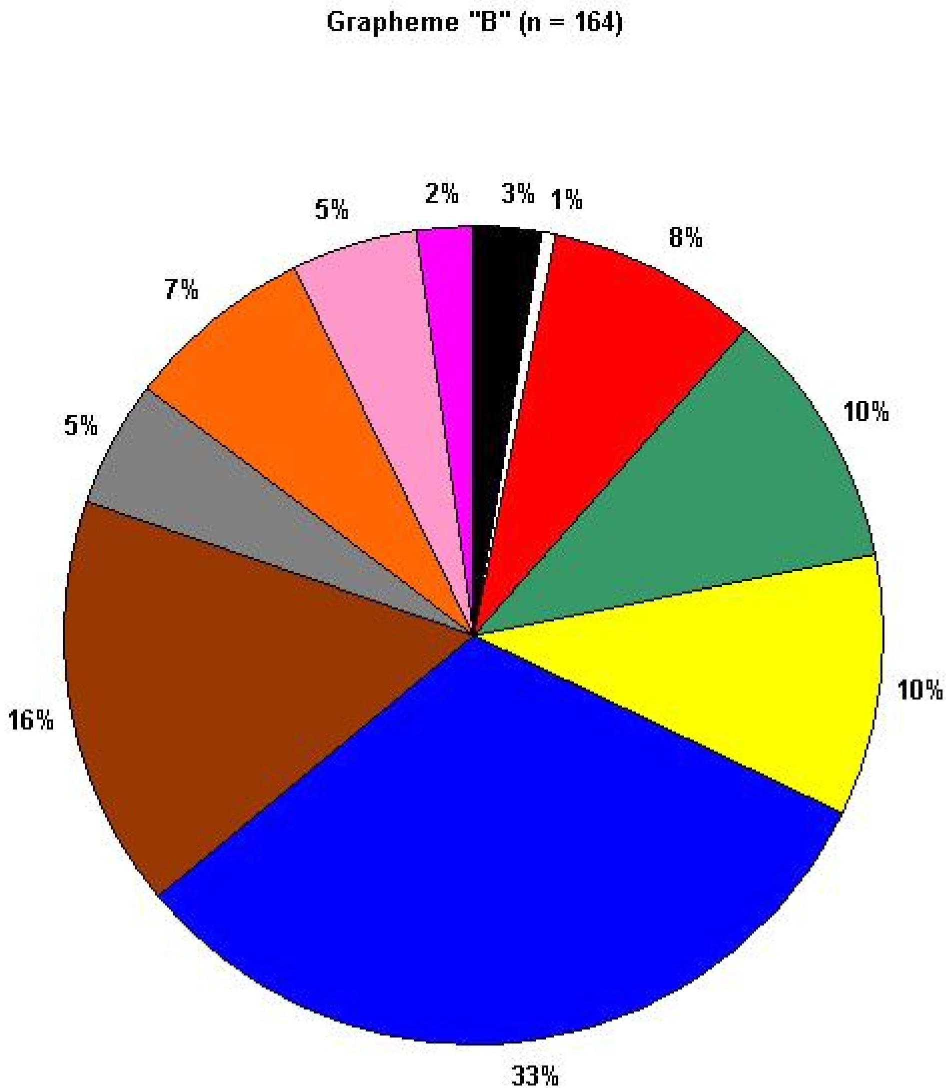


And “U” goes all over the place with no real color trend but with yellow, brown and gray as the highest percentages and a tendency to be dark.



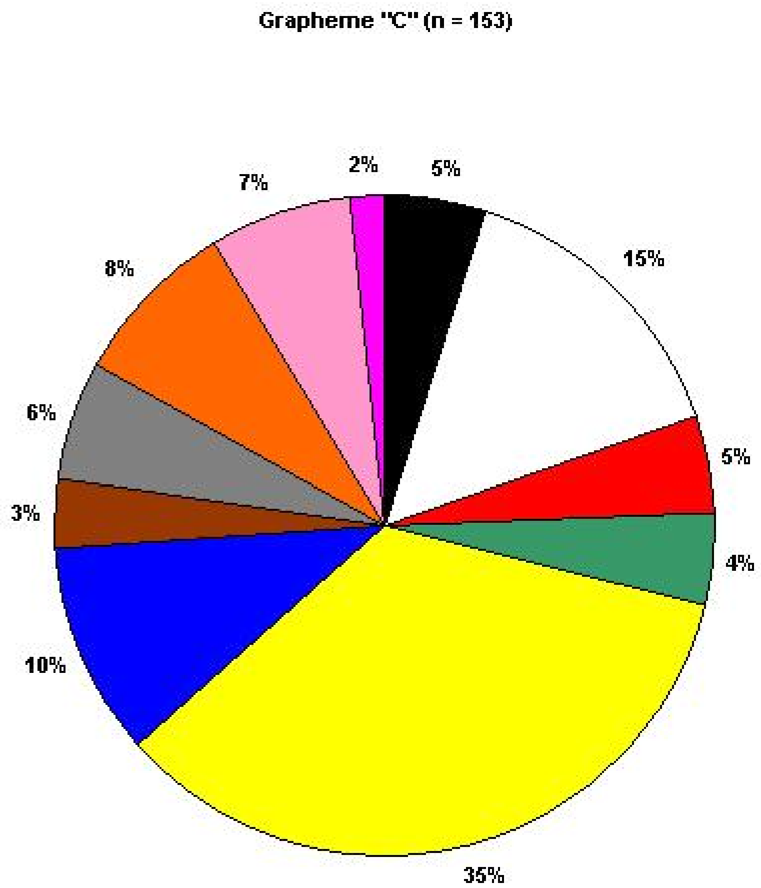
Thus, as per Berlin and Kay, we have black, white, red, and yellow, with black and white most distinct.However, it seems that, if “U” were to distinguish itself, we should predict that it would probably emerge as most often (dark) green or yellow, rather than the actually appearing more common yellow and brown.

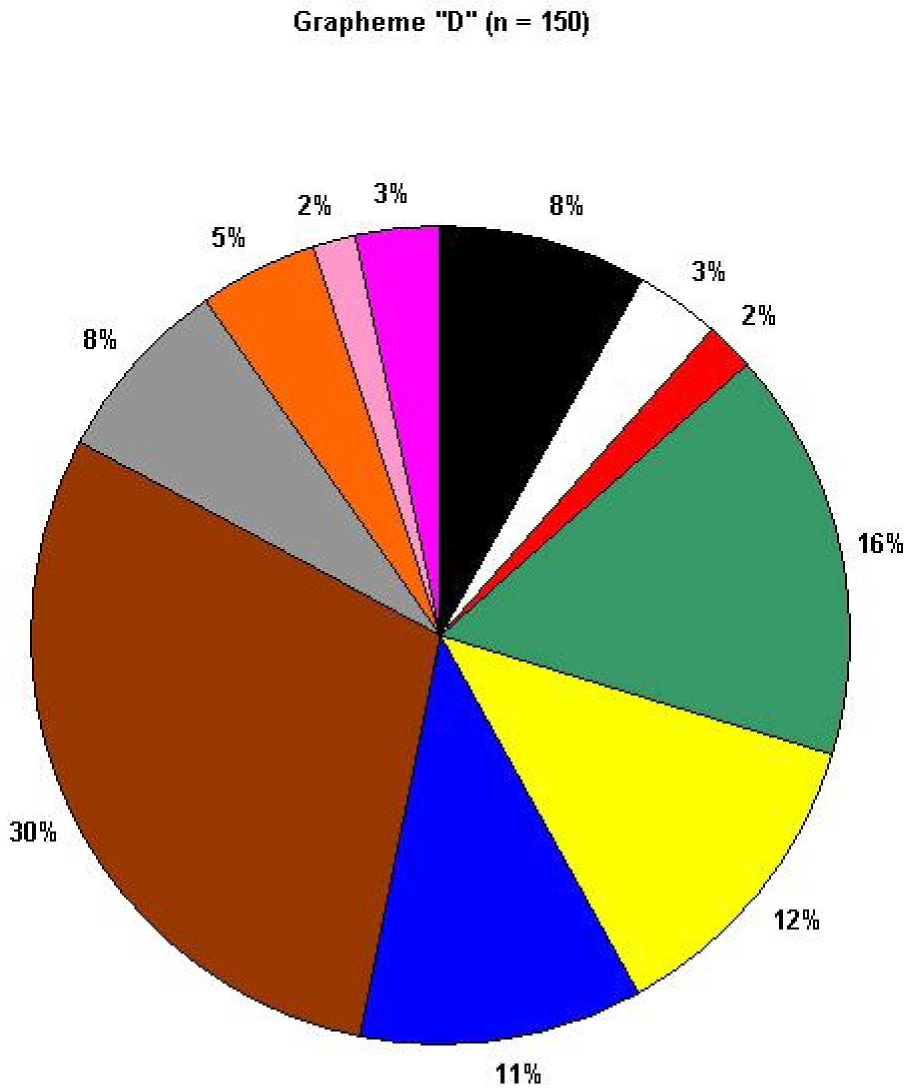
As for consonants, in general, one can say that they are usually grayer and paler (more pastel) than vowels.However, a few particular consonants show distinctive color trends among synesthetes.Contrary to the general literature on colored graphemes, although consonants do tend to be paler (pastel) and more often blended with gray, the most common color (trend-wise) is not gray.



“B” has high percentages of blue.

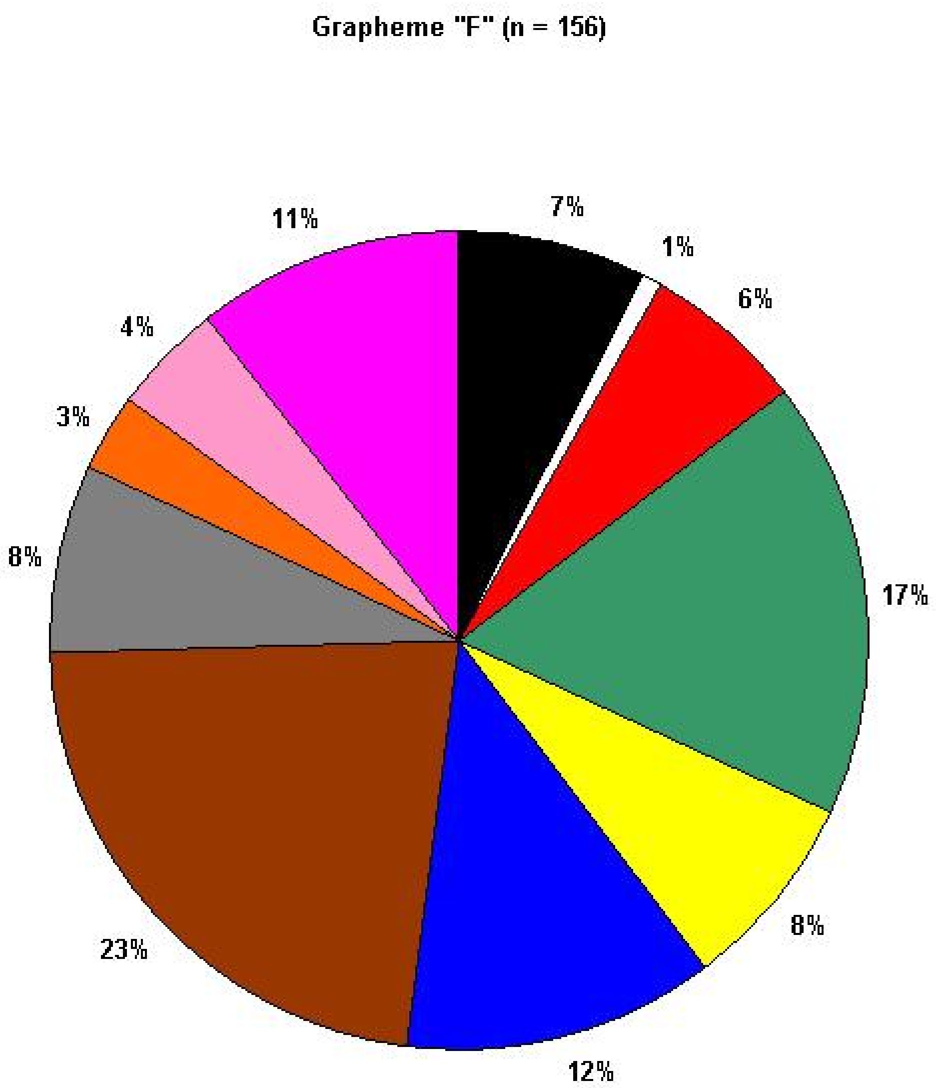
For 153 synesthetes, “C' is 35% yellow, and about 56% fall within the realm of white/yellow/gray.

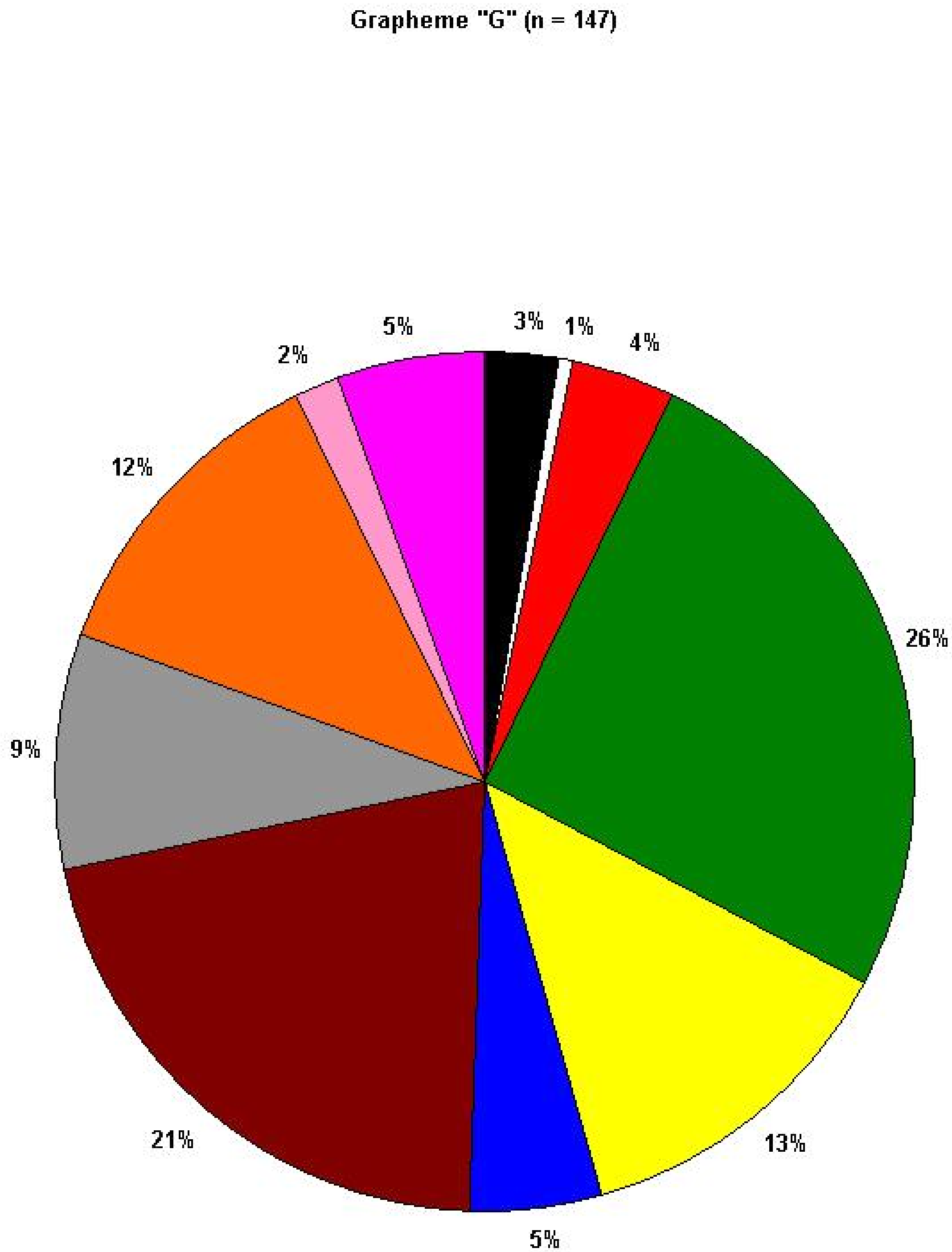

Grapheme "C" (n = 153)
2%
5%
7%
8%
15%
6%
5%
3%
4%
10%
35%



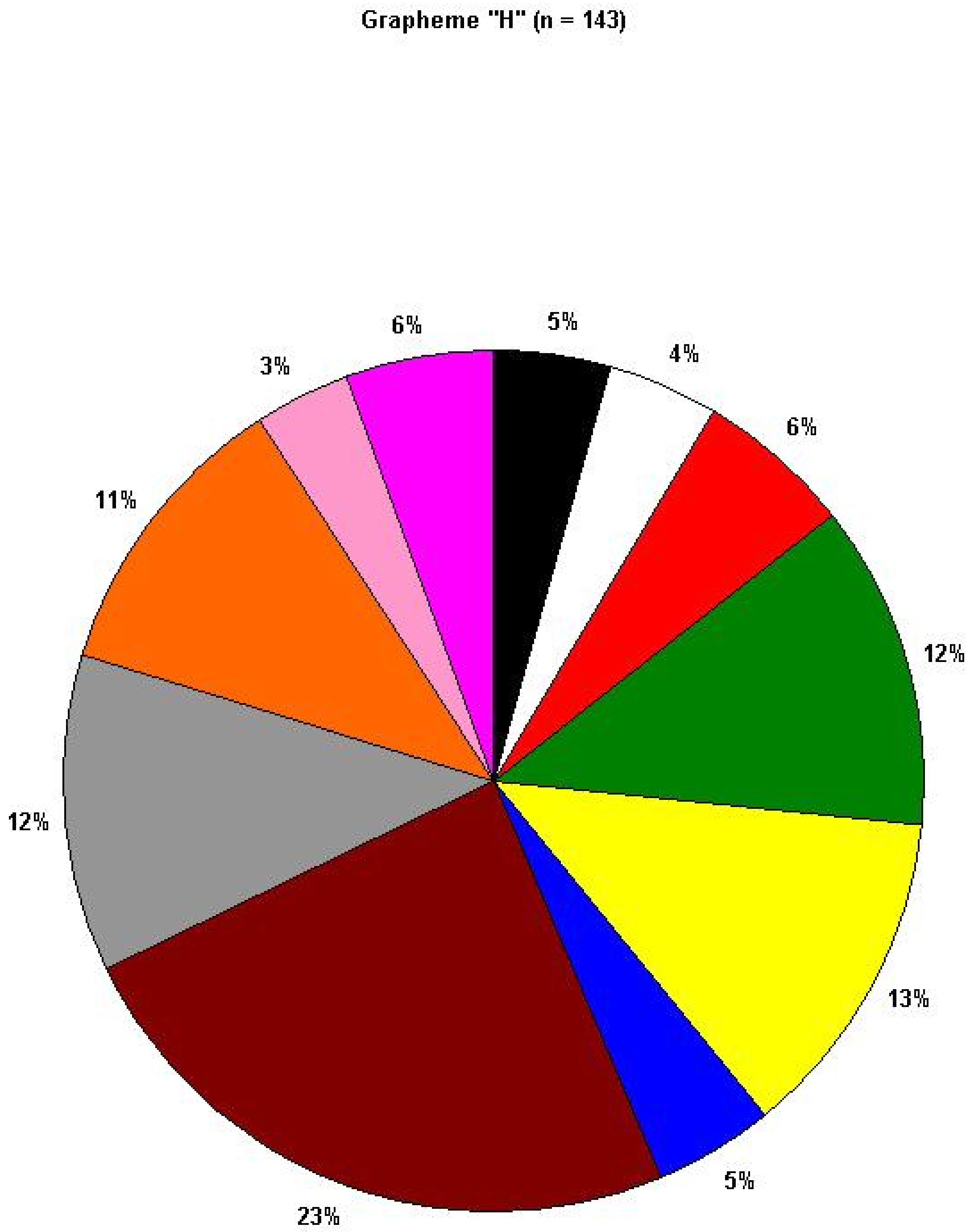
“D” has a high percentage (30%) of brown, followed by green (16%).

For 156 synesthetes, 'F' is predominantly brown (23%).

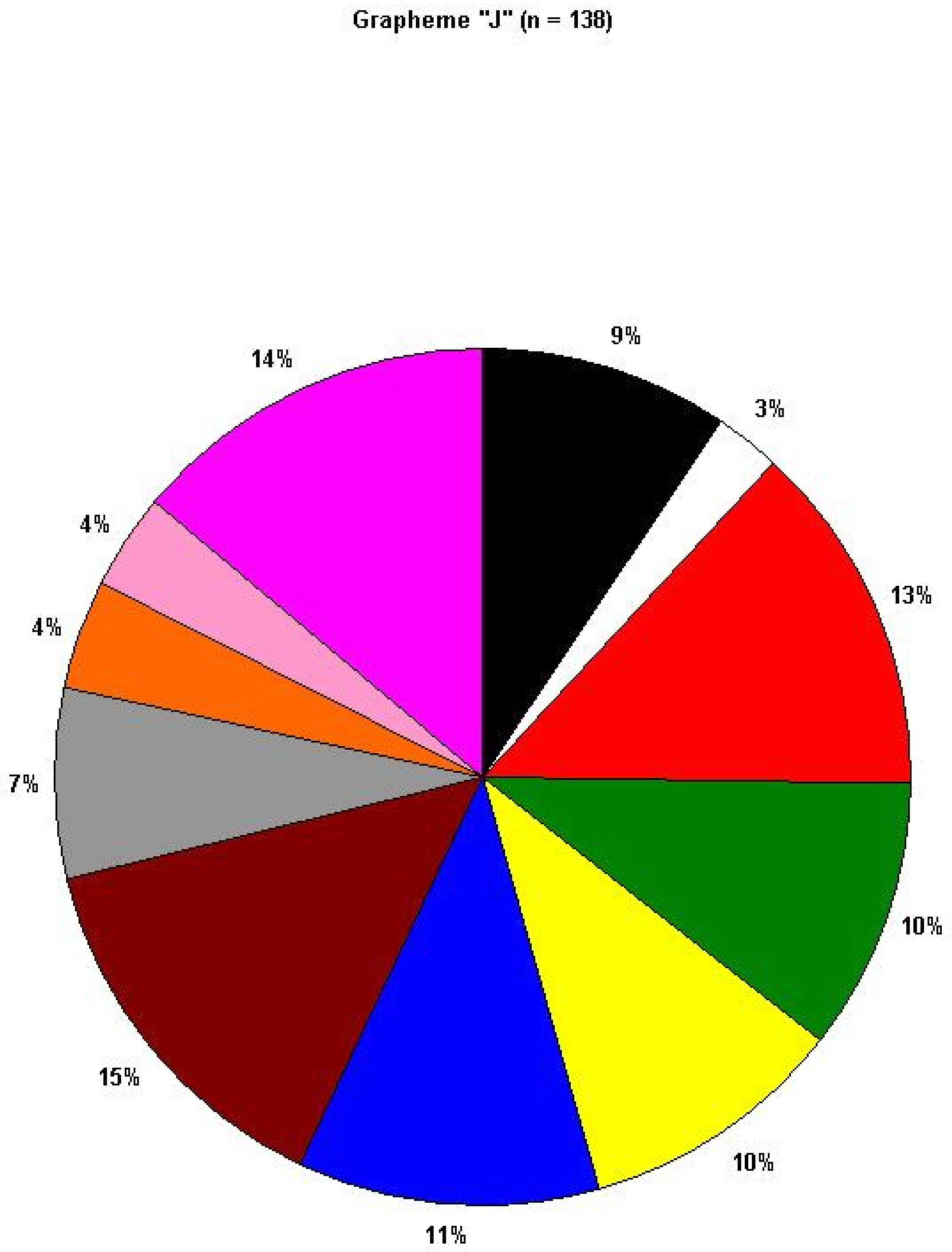

Grapheme "F" (n = 156)
7%
1%
6%
17%
8%
12%
23%
8%
3%
4%
11%



“G” holds high percentages of green (26%), and brown (21%); note the almost total absence of black (3%) and white (1%).

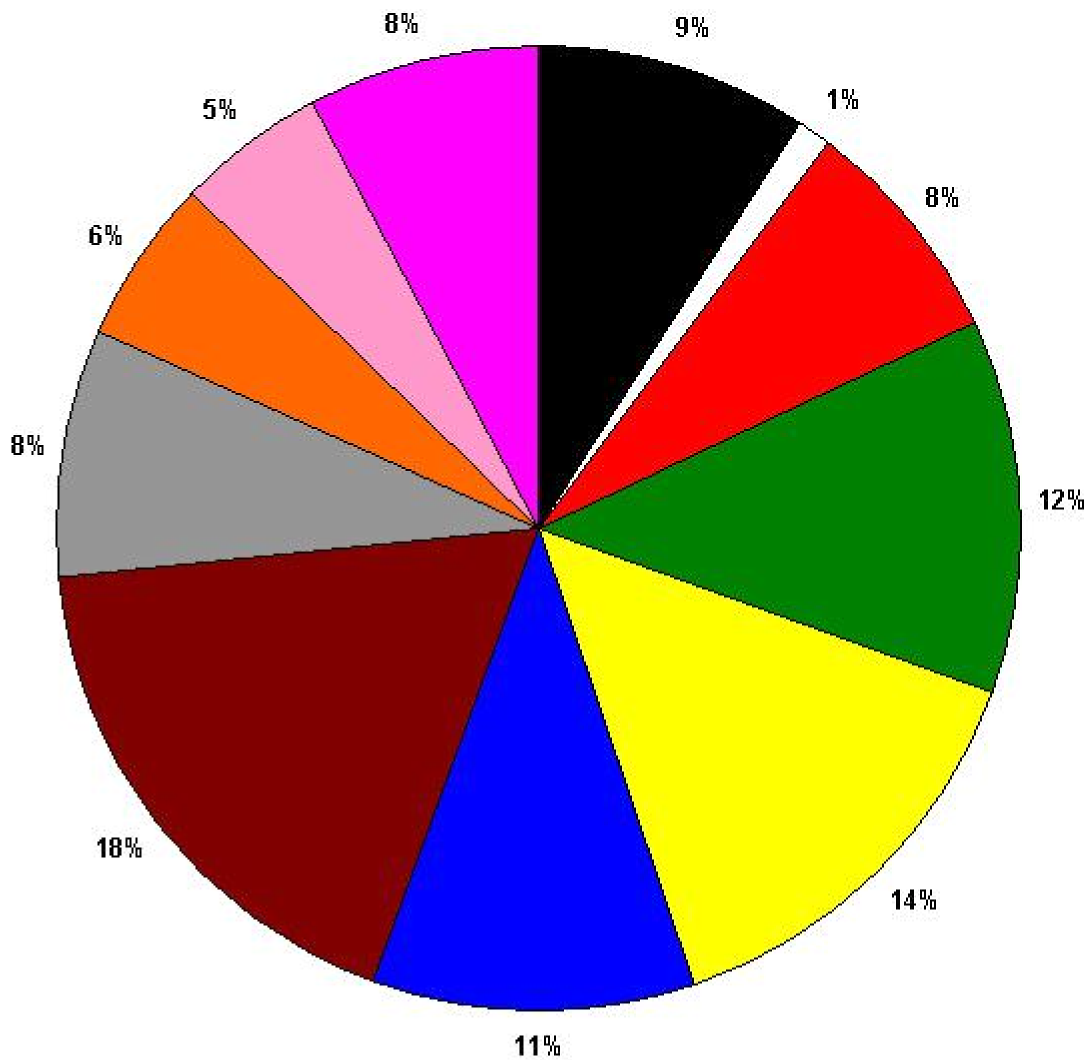


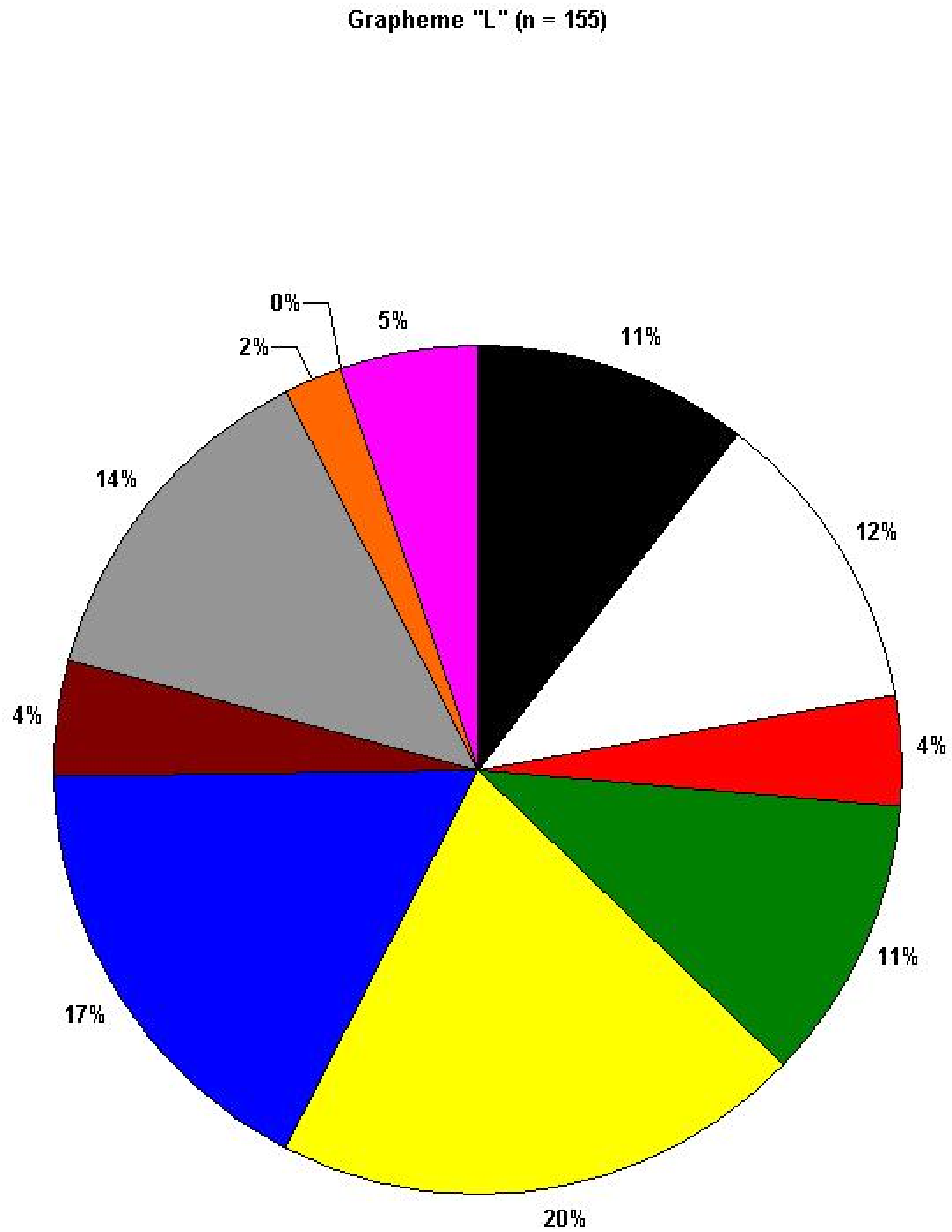
“H” holds high percentages of brown (23%), yellow, green and gray.



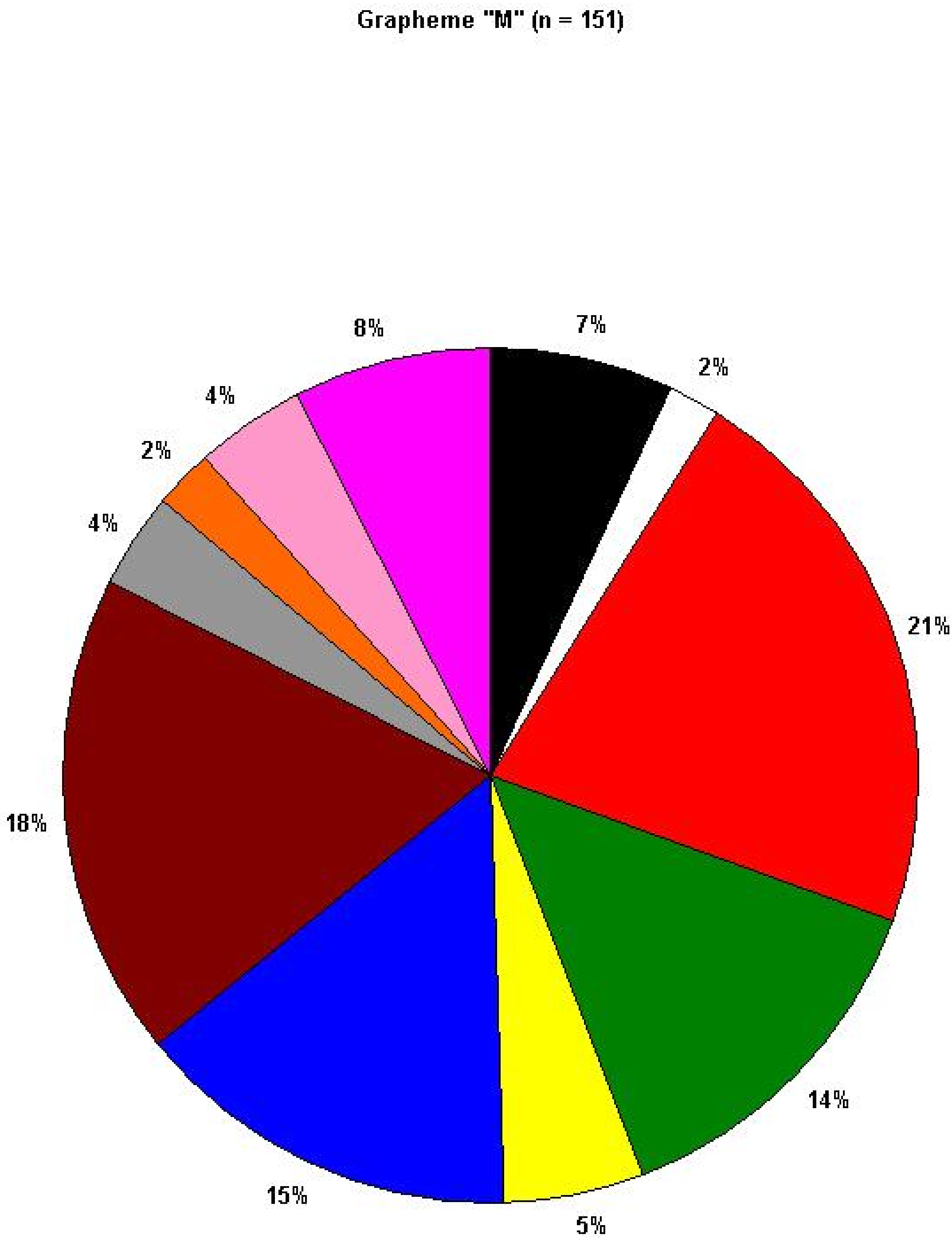
Note the high percentage of purple (14%) for “J”.

Grapheme "K" (n = 141)



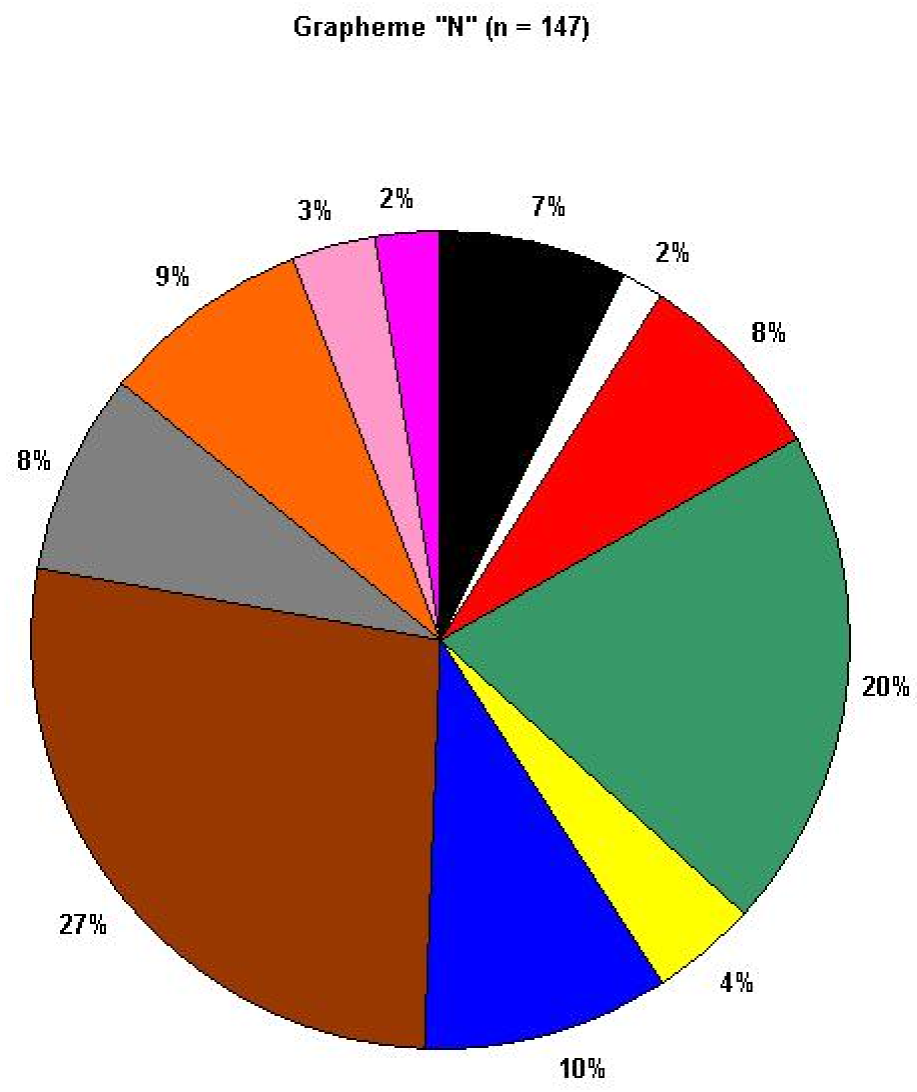


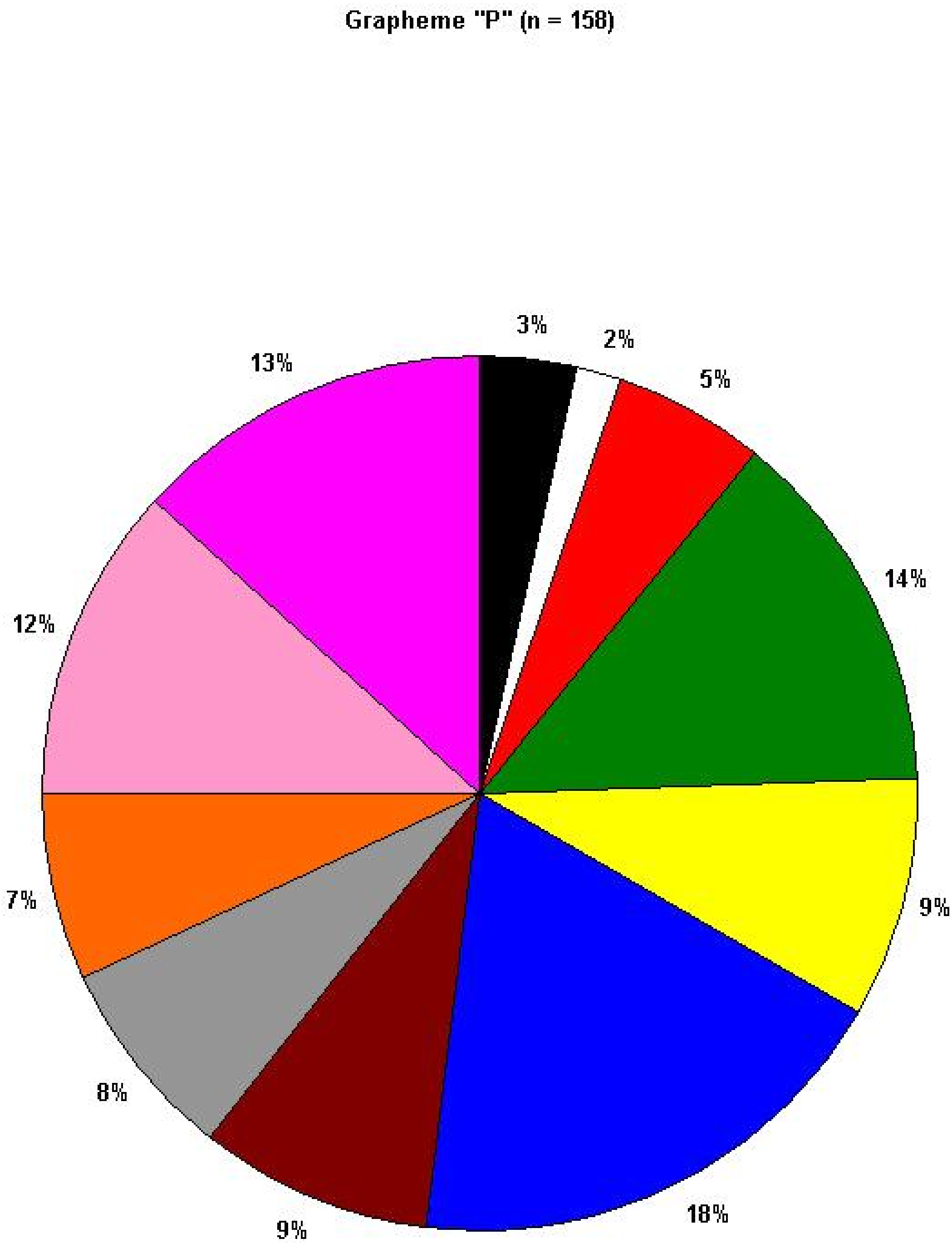
"L" holds high percentages of yellow, along with blue.



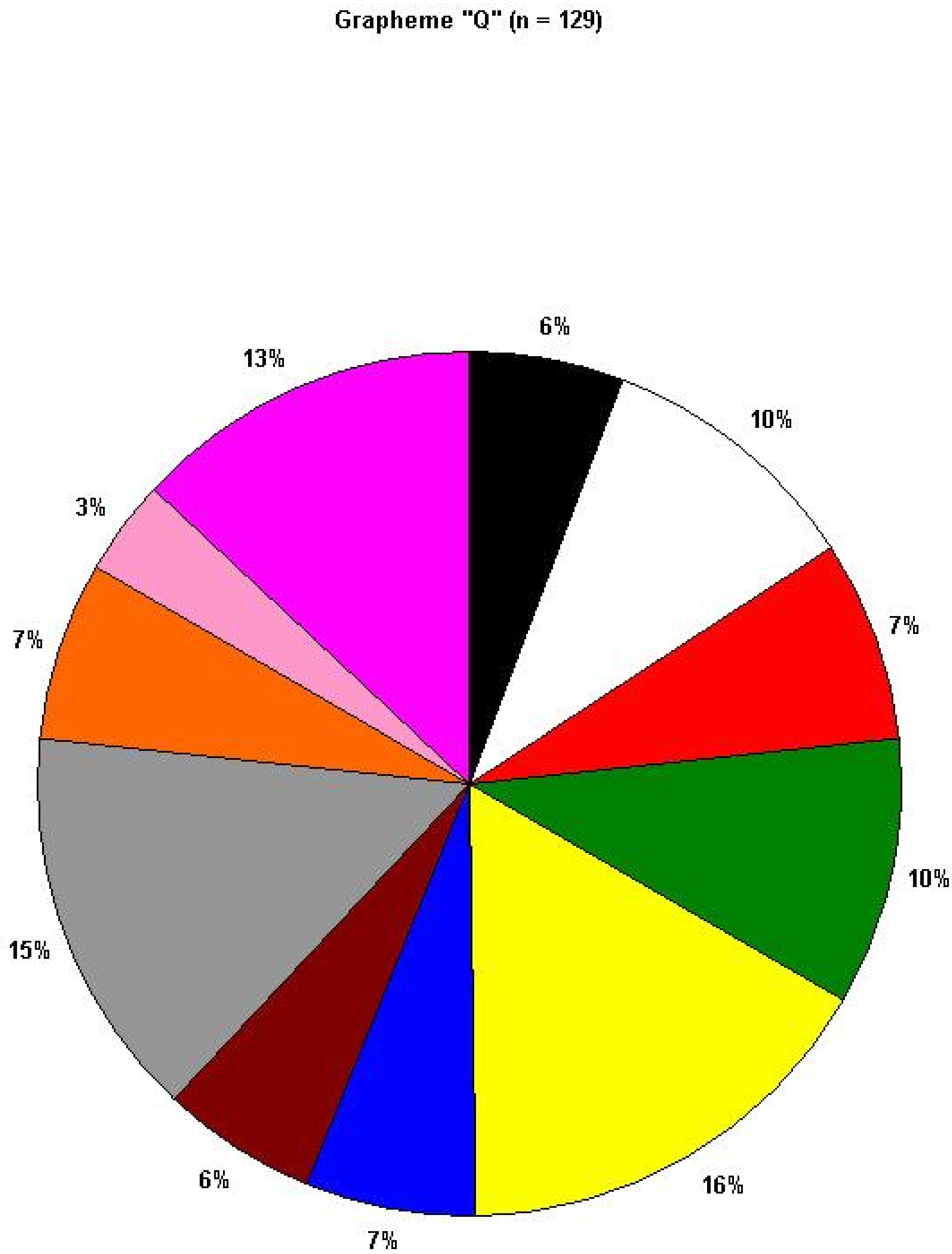
“M” holds high percentages of red and brown.

For 147 synesthetes, “N” holds high percentages of brown (27%), followed by green (20%).


Grapheme "N" (n = 147)
2%
7%
2%
8%
20%
4%
10%
27%
8%
9%
3%

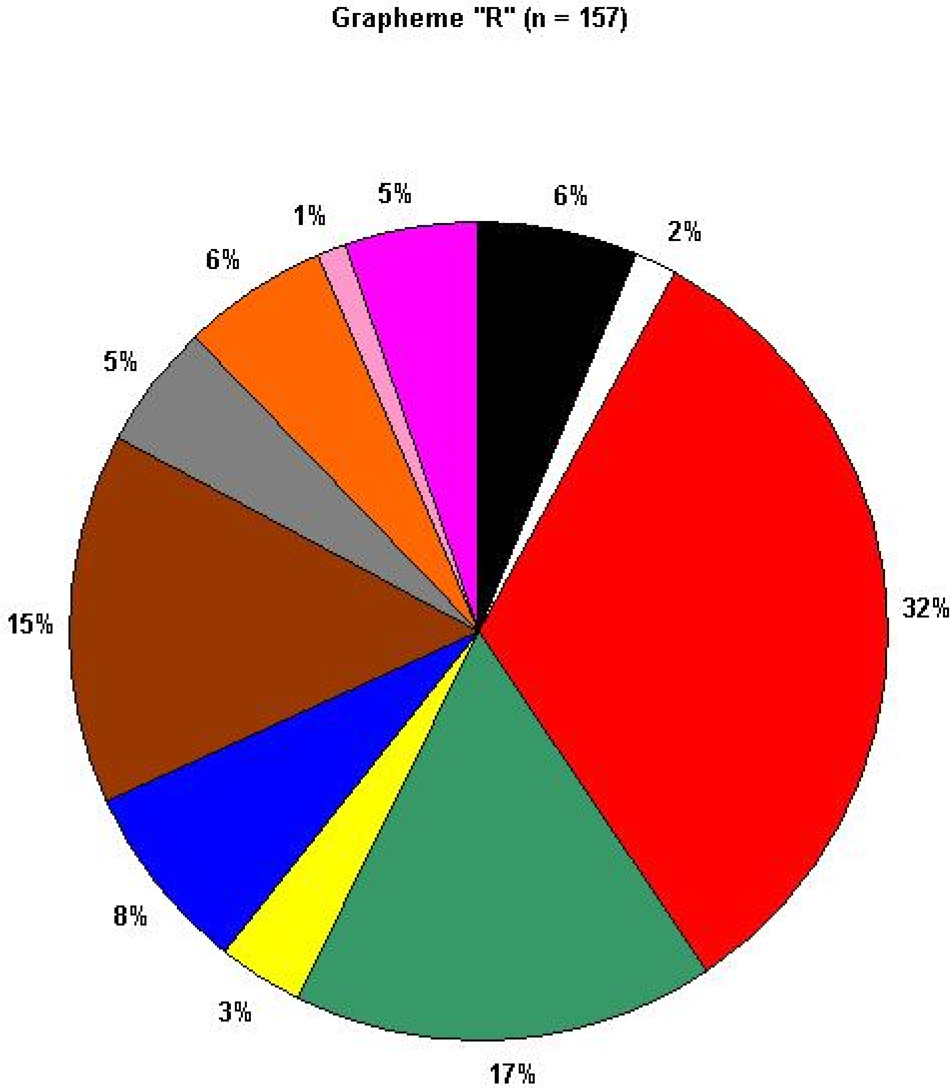


Note the relatively high percentages of pink (12%) and purple (13%); this might be attributed to the words (in English and other languages) beginning with the letter “p”.

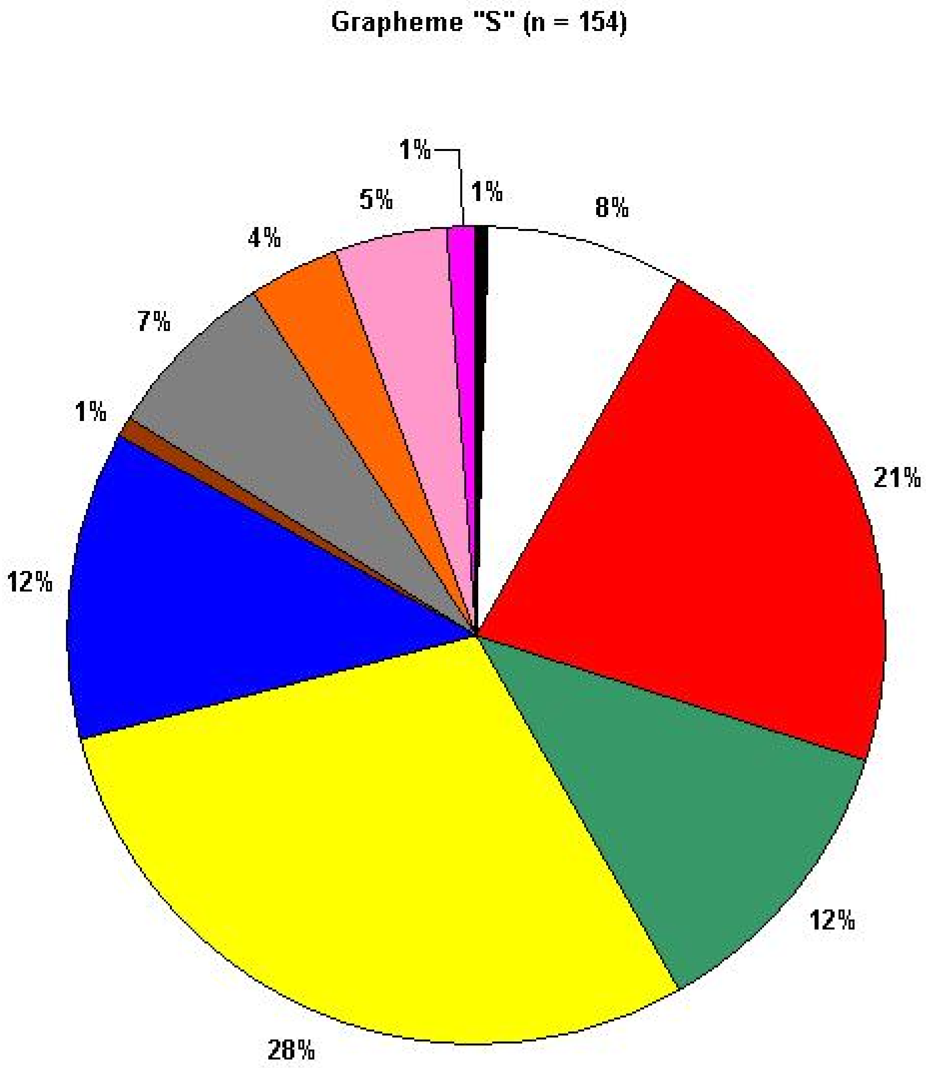


Again, note the relatively high percentage of purple (13%); here, the percentage may just be serendipitous, as I have found no other apparent explanation yet.

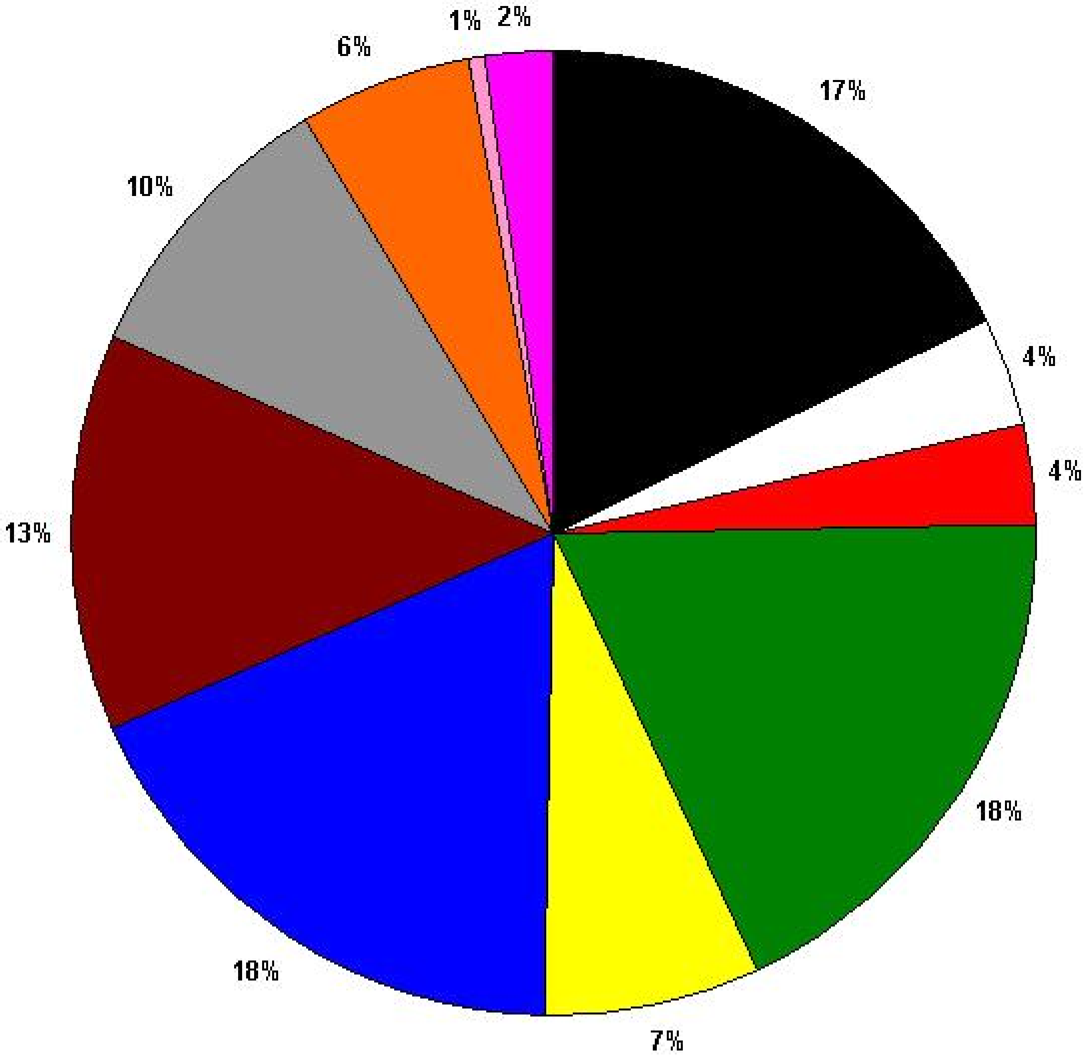
For 157 synesthetes, “R” shows a strong (32%) tendency towards red, with smaller but perhaps significant shadings towards green (17%) and brown (15%).The tendency towards red might be explained via associative theories, holding that it has a connection with “r” being the initial sound of English “red”, French *rouge*, German *Rot*, Italian *rosso*, and various other names for the color in Indo-European languages.

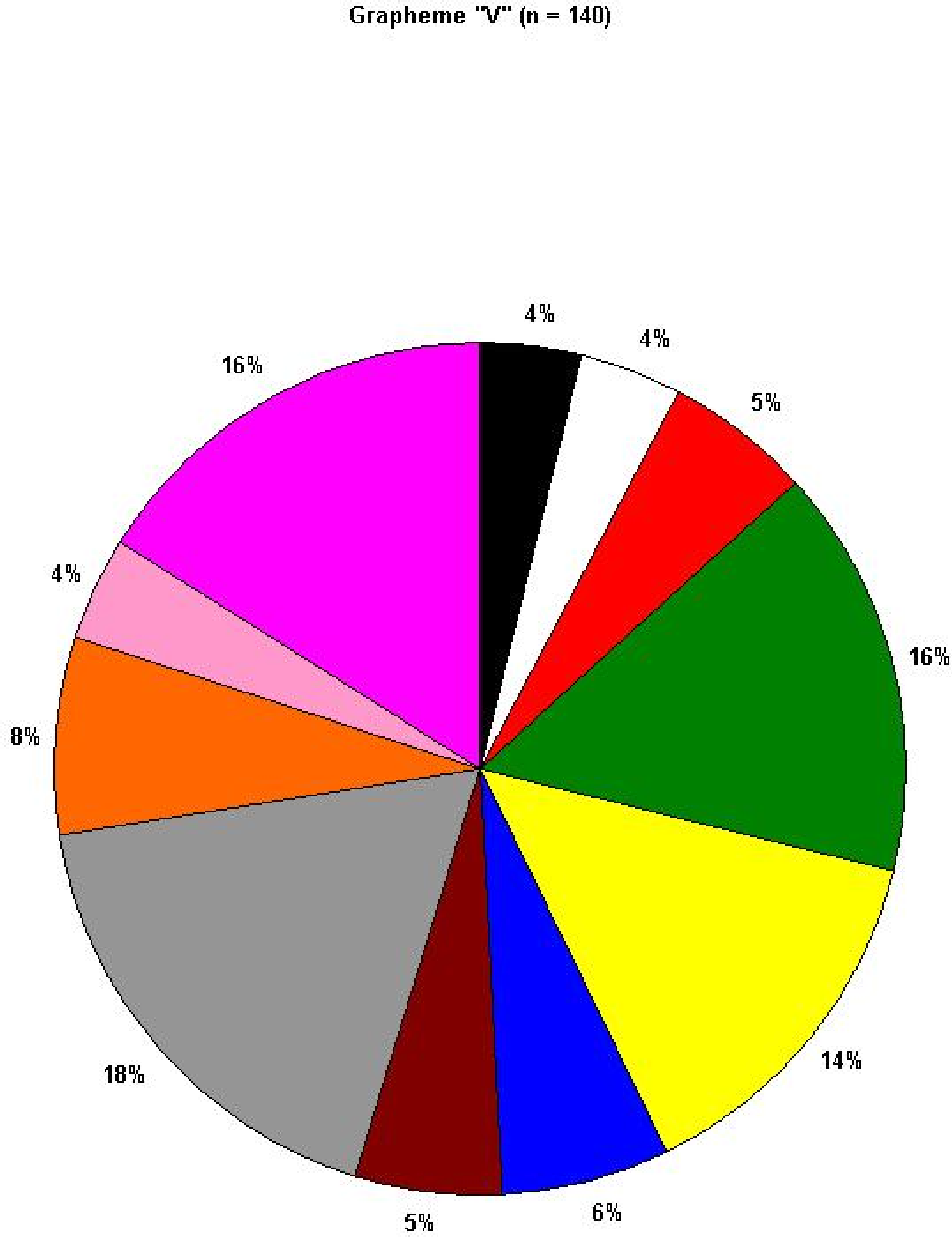


“S” is highly unusual in that about 28% of the 154 synesthetes I culled my data from report seeing “S” as yellow, but there is also a high percent (21%) of red.Note that there is also extremely little black (1%) and brown (1%).

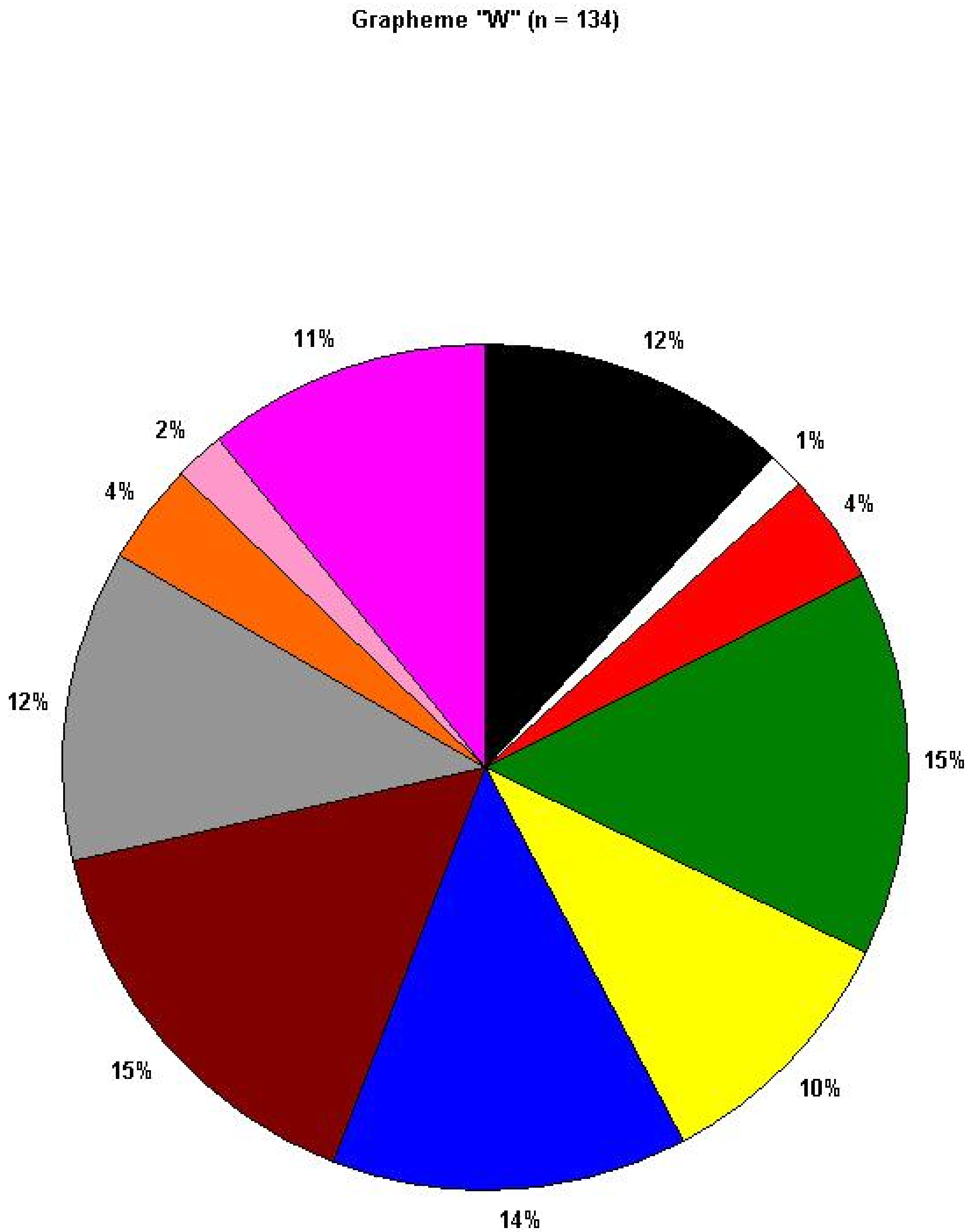

Grapheme "S" (n = 154)
1%
1%
5%
8%
4%
7%
1%
21%
12%
12%
28%

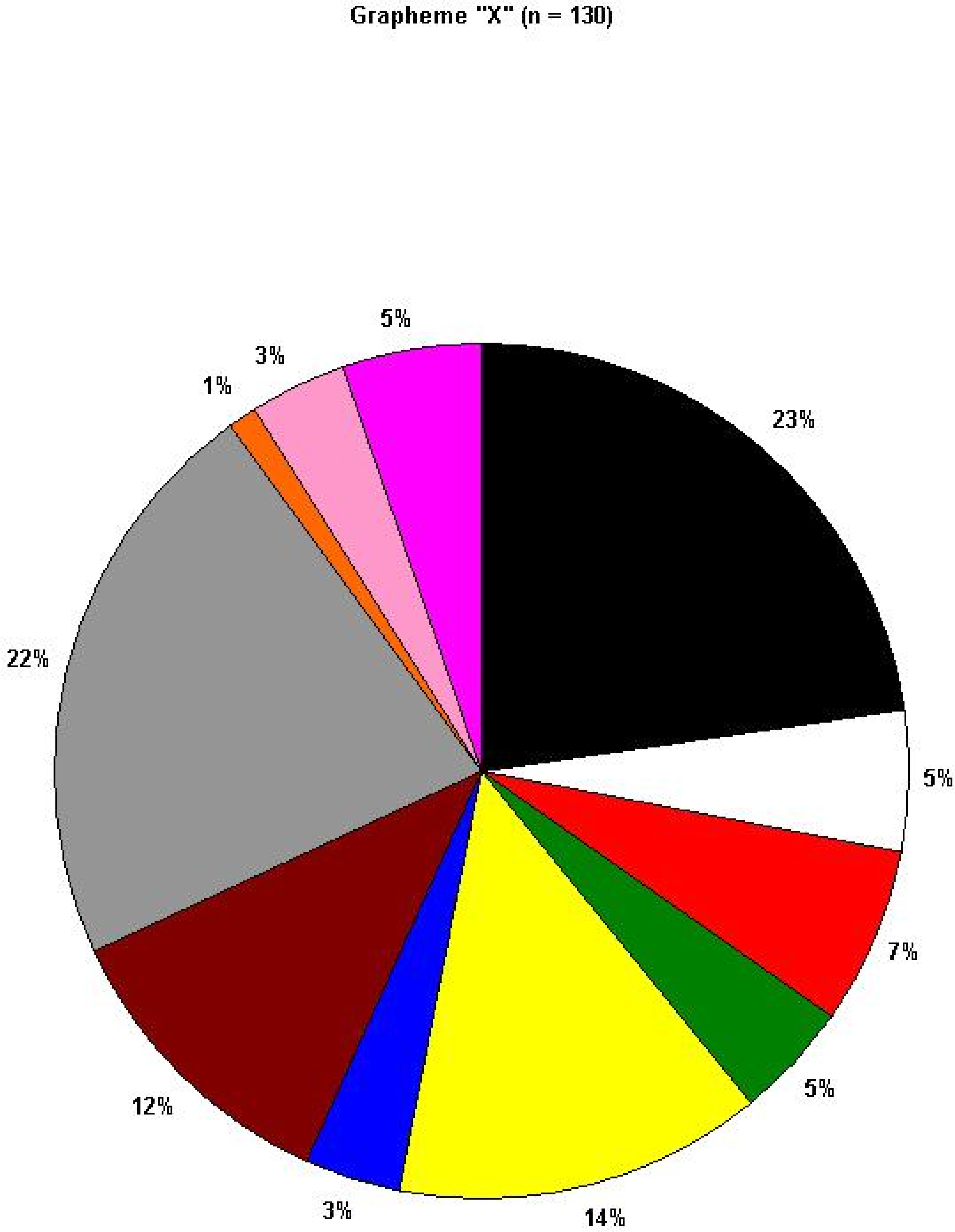
Grapheme "T" (n = 157)





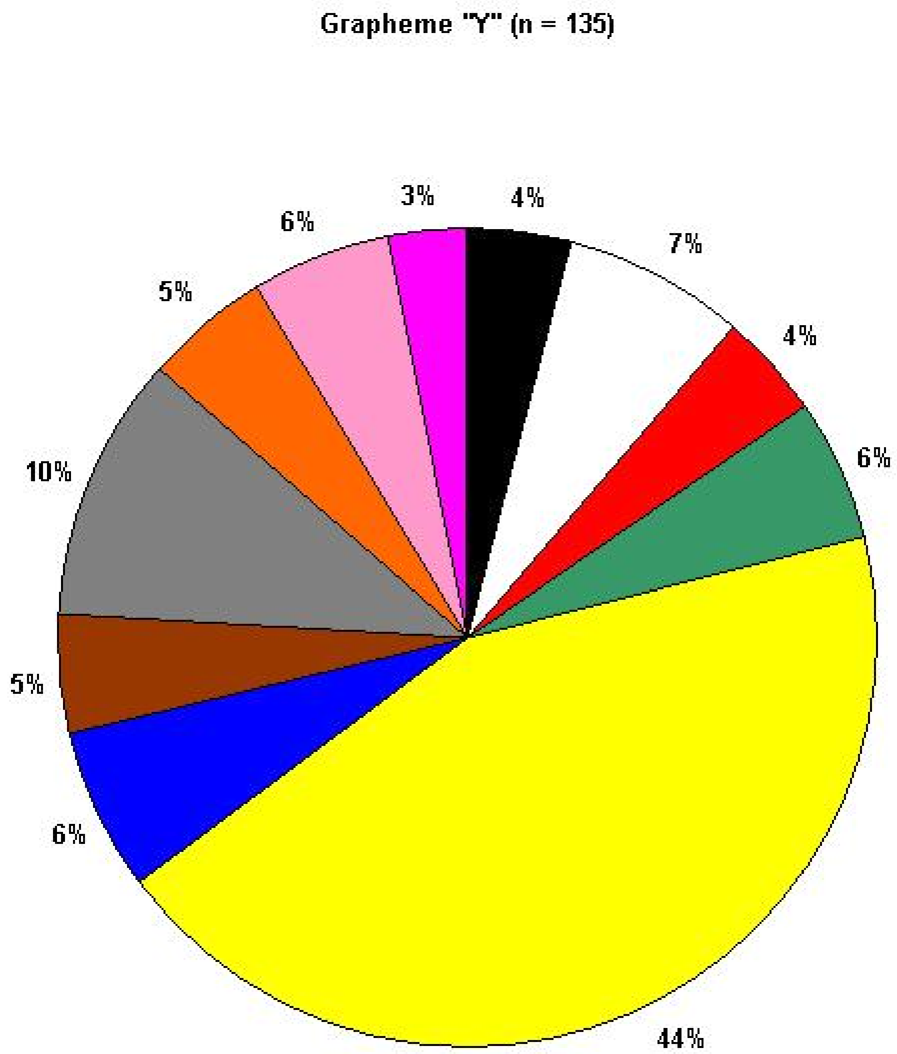
Note the relatively high percentage of purple (16%).This might be attributed to association with the word “violet”.

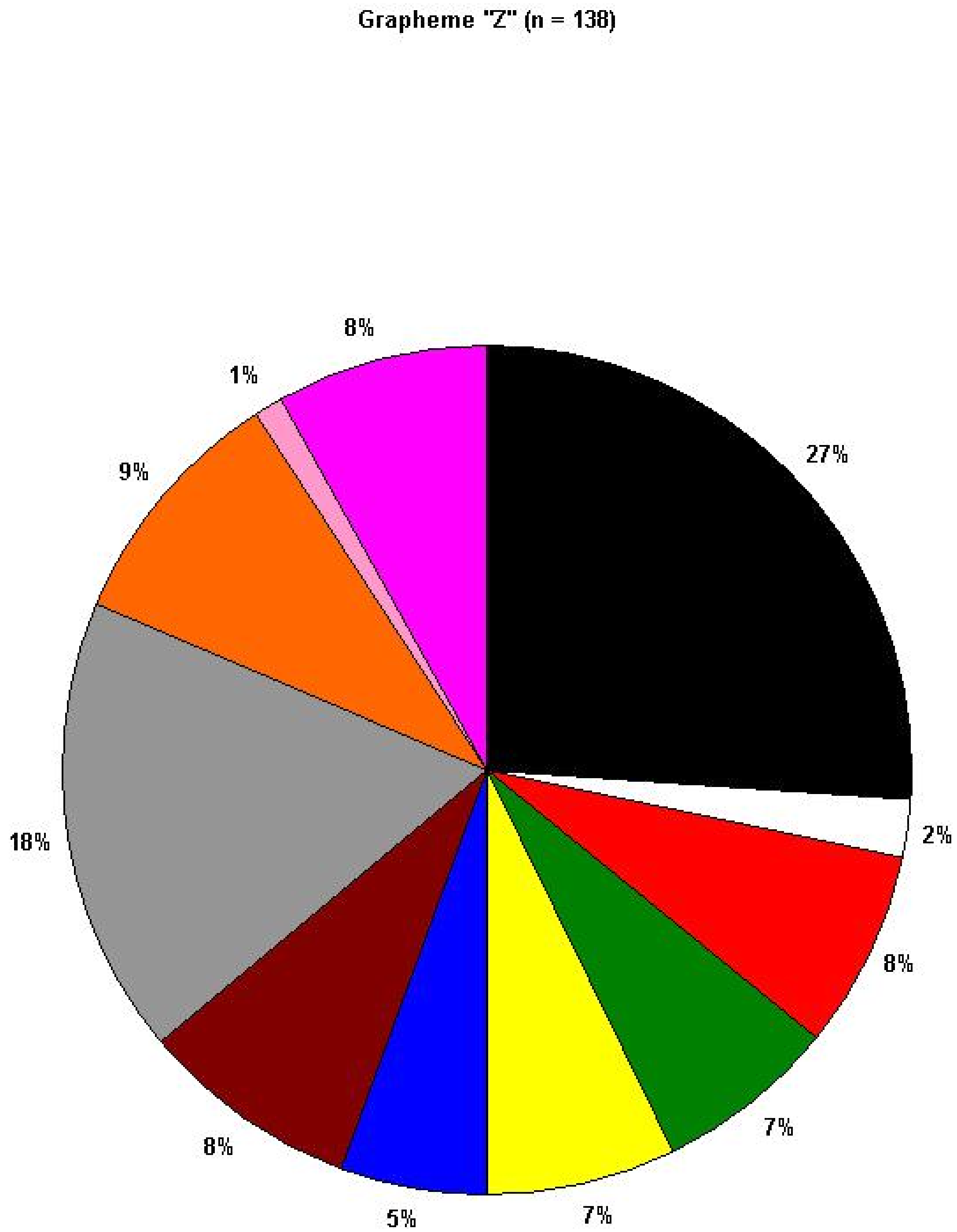

Grapheme "W" (n = 134)
12%
1%
4%
15%
10%
14%
15%
12%
4%
2%
11%



Note the high percentage of gray (22%); considering also black (23%) and white (5%), “X” appears colorless to 50% of grapheme > color synesthetes.

For 135 synesthetes, “Y” has a significant (44%) inclination towards yellow, plus a strong (10%) tendency towards gray, a bit more than what is usual; we could try to explain this via an associative connection with the initial sound of the English word “yellow”, but it would not hold for the German word *Gelb*, nor French *jaune*, nor Italian *giallo*.





“Z” holds a high percentage of black (27%), followed by gray (18%); yet note the small (2%) percentage of white.

Alison Motluk (1997), Richard Cytowic (1989), and many others have reported on how colored words usually tend to obtain their colors based upon either the initial letter or the first vowel sequentially -- and this “letter” is far more often the grapheme, rather than the phoneme.If synesthetically colored words in English, German, French, and other Indo-European languages are often colored based upon the initial letter or first vowel of the word, can we assume a similar thing for Japanese, with the first kana character coloring the word?How about for other syllabic systems, such as Cree or Cherokee?Would the left-most or top radical component of a Chinese character color the entire individual character?I currently only know of one person with colored Chinese characters, Hua Min, who says that, although he is not exactly certain how they do “work”, they don't work based on any aspects of component parts.

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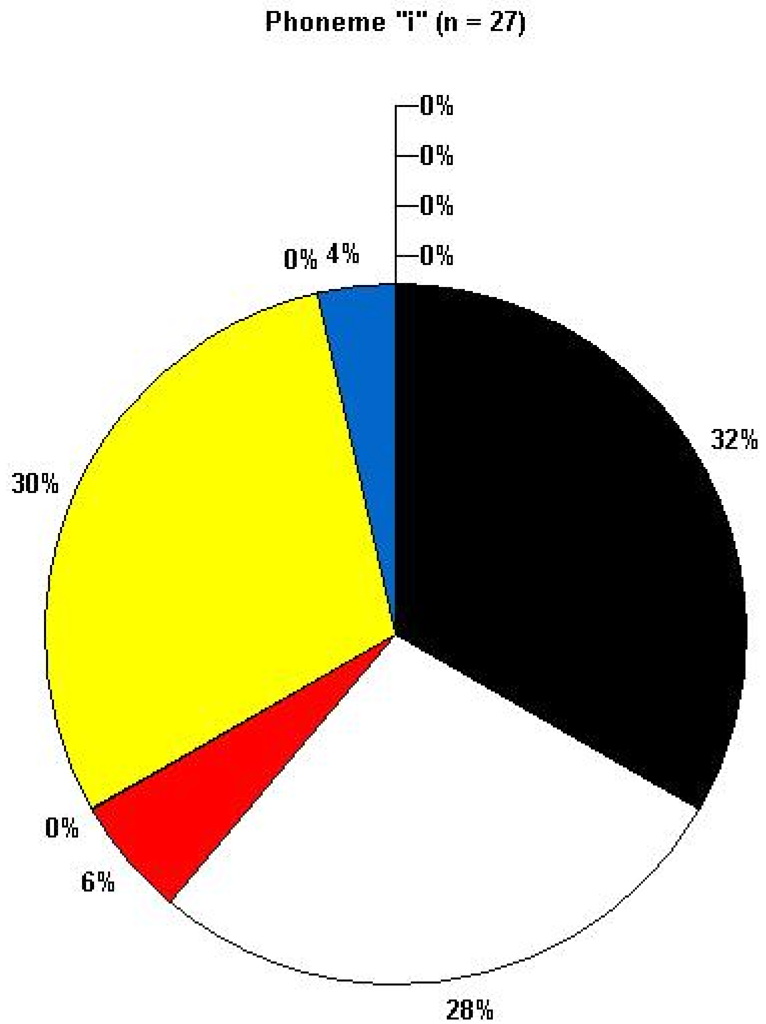
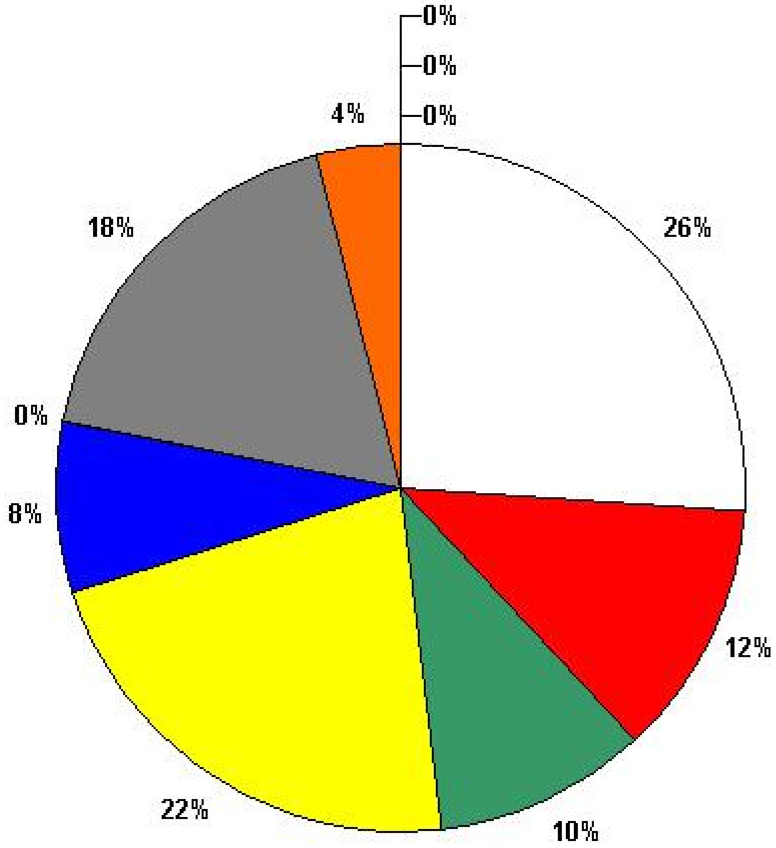
3. Colored vowel phonemes

One key issue here, however, is that my study of colored letters deals with graphemes, while the various studies of sound symbolism I have mentioned deal with perceptions of phonemes.In my investigations, I am not overlooking this point; rather, my research addresses questions of the relationships between the graphemes and the phonemes.Although my data is scant at the moment, I can report an initial start for observations of colored phonemes as distinct from graphemes.I find that the phoneme [i] tends to be black (32%) or yellow (30%), or, to only a slightly lesser degree, white (28%), for the 27 synesthetes surveyed.

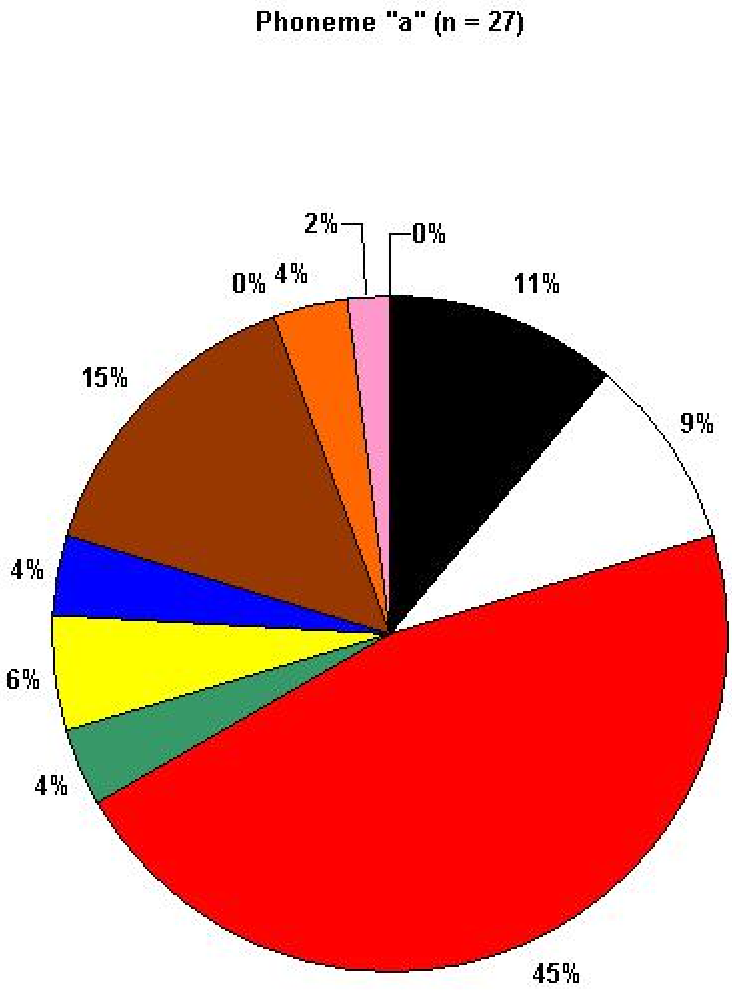


For 25 synesthetes, [e] tends to be white (26%) or yellow (22%); note the total absence of black.

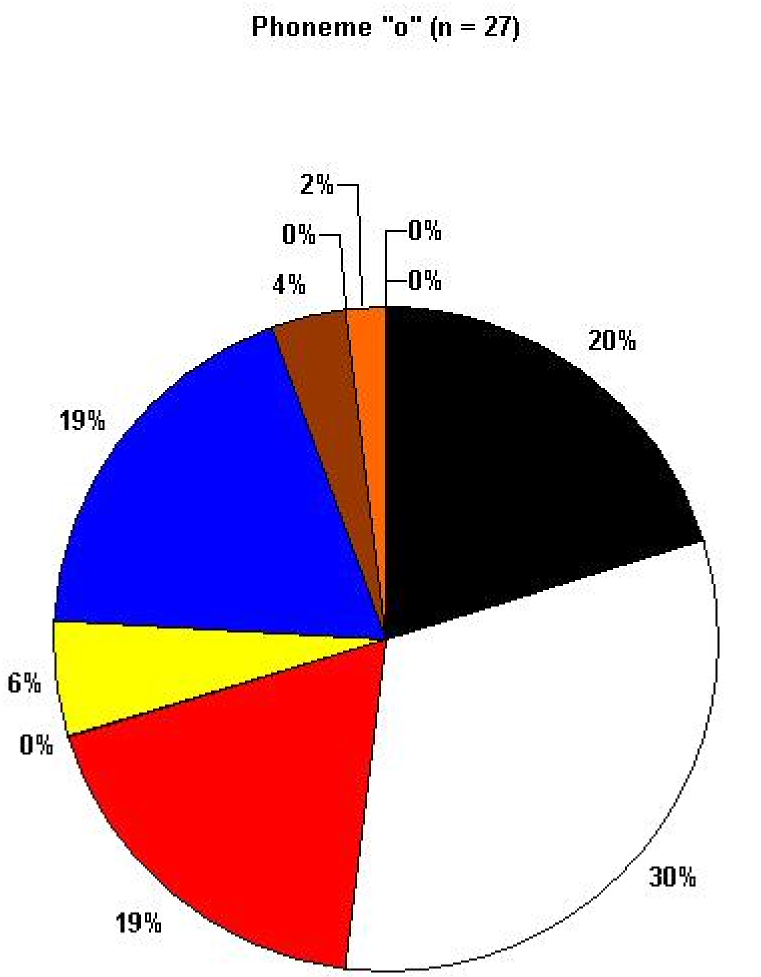
Phoneme "e" (n = 25)



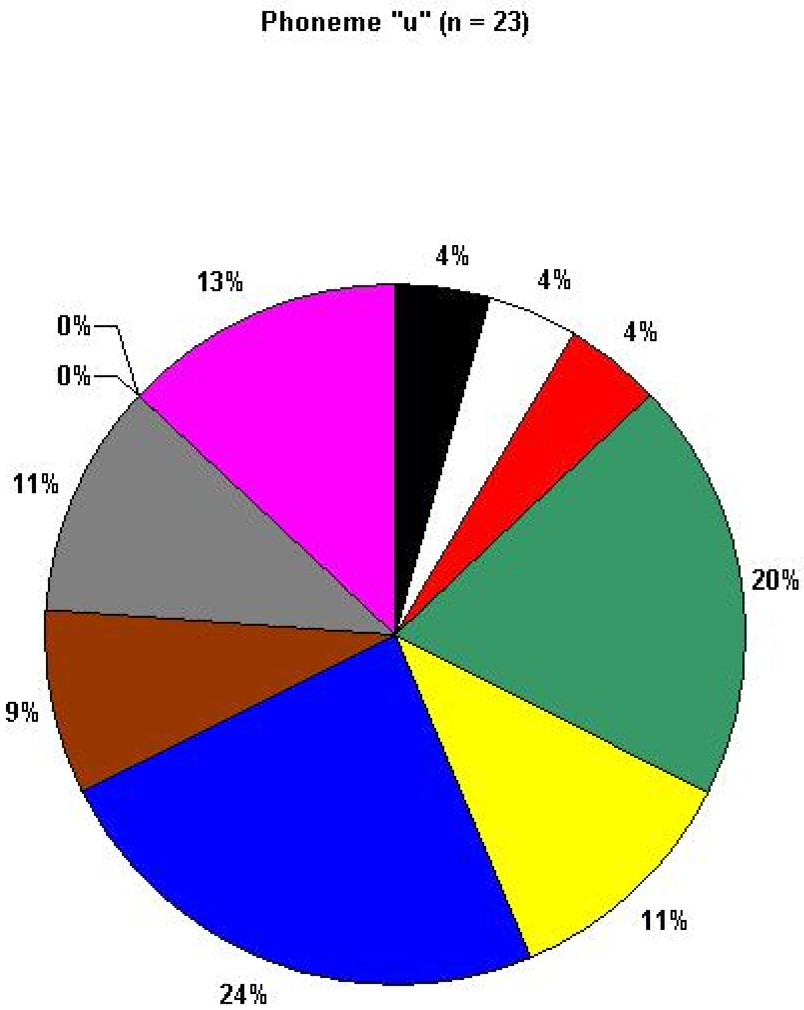
For 27 synesthetes surveyed, [a] has an overwhelmingly strong tendency to be red (45%).



[o] tends to be white (30%) for 27 synesthetes examined, although black (20%), red (19%), and blue (19%) also appear at noticeable percentages.



And, for 23 synesthetes, [u] is all over the place, with no distinct trend (although blue seems to be most common) but a general darkness.



This goes somewhat against the findings of others, such as Lawrence Marks (1997/1975), who also investigated colored phonemes as distinct from colored graphemes, compiling and tabulating a huge set of data culled from hundreds of synesthetes.Points of difference are that Marks found [o] to tend to be red, with a lesser tendency towards black; and, for Marks, [u] tends towards black.

Let's compare this to the colored grapheme data:The phoneme [i] tends to be black, yellow or white; the grapheme 'I' tends to be white or black.The phoneme [e] tends to be white or yellow; the grapheme 'E' tends to be green or yellow; both show a fair tendency towards bright yellow.The phoneme [a] tends overwhelmingly to be red; the grapheme 'A' also tends strongly to be red; here, we have marked agreement.The phoneme [o] tends towards white; the grapheme 'O' towards white; here we also have some agreement.And the phoneme [u] tends in general to be dark, while the grapheme 'U' has no particular one color but tends to usually be dark.Summarizing, [i] and 'I' have overlap for the connection to black and white; [a] and ‘A’ to red; and [o] and ‘O’ to white.

One argument here with these associations is that the names of the letters and the sounds of the phonemes might interfere with each other.Keep in mind, however, that we are looking at other languages besides just English and, contra to English, the names of these letters in languages such as German and Italian are closer to that of the phoneme sounds (which, of course, remain constant).

If a synesthete does have colored phonemes, it is quite common that it will only be for vowels.If consonants are also colored, it is not uncommon that not all of the consonants will have a color.I do not, I feel, as of yet have sufficient data to reliably talk about trends or lacks thereof among synesthetically colored consonant phonemes.

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4. Sound Symbolisms

This all ties in with the topic of sound symbolism.As previously indicated in Jakobson (1962) and Greenberg (1978), and as elucidated in Hinton et al. (1994), there are general trends -- although distinctly are not “universals” -- among human languages to associate the vowel [i], and to a lesser extent, [e], with small, bright, and physically high things, and the vowels [a] and [o] with big, dark, physically low things.This is reflected, for example, in the language Huastec, a Native American language of Mexico, in which [i] and [e] are used in onomatopoeias which denote high-pitched animal cries, and [a], [o], and [u] are used in those which denote low-pitched cries (see Kaufman 1994).

In Haumbisa, a greater percentage of high front vowels ([i] and [e]) are used in bird names than in fish names (see Berlin 1994); birds are generally perceived as smaller and brighter in this culture.A high percentage (40%) of bird names have [i] in the first syllable (which is the most predominant and influential syllable in the language's morphology).A very low percentage (8%) of fish names use [i] in the first syllable; 60%, however, employ [a] in the first syllable.

In general, this trend can also be found in the African languages Ewe, Twi, Gã, Guang, Nupe, Temne, Gbaya, Nembe, and Kisi (Childs 1994), and even in the Khoisan (“click”) languages such as Nama (Hagman 1977), !Kung (Shostak 1981), and !Xóõ (Traill 1985, 1994), where front vowels equal “bright” and back vowels equal “dark”, high tones equal “small things” and low tones equal “large things”.In Yag Dii, another African language, high tones are used to denote things which are “small, thin, empty, shining, high, tight, or/and complete”, while low tones are used to denote the “abnormal”, “fear”, and things which are “early” (Childs 1994).These phenomena are also seen in Maori, Japanese, (at least some varieties of) Mandarin, and English (see Hinton et al. 1994).

As mentioned in Ultan (1978), feminine and diminutive are far more often represented by front high vowels, or by ablauts, than by back or low vowels -- incidentally, Ultan points out that the integration of masculine and diminutive is quite rare in human languages.This is seen, for example in languages such as Arabic, Greek, Hebrew, Khasi (a language of the Mon-Khmer family spoken in eastern India), Rotuman, Punjabi (an Indic language), and Swahili.In Dakota (a Siouan language spoken by native North Americans), the ablauts used to denote feminine and those used to denote diminutive are closely related.

As mentioned before, however, not all human verbal languages hold to these trends:For the Nez Perce (a Sahaptin-speaking tribe of native North Americans who traditionally occupied central Idaho, and western Washington and Oregon), for example, [e] is quite more often used as an element in words which denote “big”, while [a] is used as a diminutive (see Aoki 1994).In Bahnar, a Mon-Khmer language, [i] is a phonomorphological element used for “big”, and [a] is used for “small” (see Diffloth 1994).

Now let us return to Berlin and Kay's (1969) color term paradigm.What would the situation be like if we, instead, were operating with synesthetically colored (Mandarin) Chinese character symbols.Mandarin Chinese basically has eight base color terms.Arranged as per Berlin and Kay's paradigm, they are as follows (here, I use the kind of Mandarin spoken in the northwest of Taiwan; I omit the sè addition):

```
bái \            / lü` \                          *****
      > hóng <          > lán >  *****   *****    *****
hei /            \ huáng /                        *****
                                                  |zî(???)
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I omit Mandarin hè(sè) (“brown”), since, although it does exist, it is seldom used; kafei(sè) (“coffee-colored”) is the common term.As Berlin and Kay point out (1969: 85), huei (of hueisè), “gray”, actually designates “ash”.Likewise, jü' (of jü'sè, “orange-colored”) designates the orange-colored citrus fruit, the mandarin, and does not stand alone as a basic color term; the same holds for chéng, which denotes the orange fruit.Berlin and Kay (1969: 84) propose that Mandarin has six basic color terms; I would suggest that Mandarin skipped over “brown” to add “purple”, zî(sè), thus giving seven terms.

As mentioned before, there have been colored-letter synesthetes who have had sets other than the Roman alphabet characters.Such characters as German umlauts, French accented vowels, and Danish and Swedish å, ø, and æ are not uncommon.Henning (1923) mentions one of his students who had a colored Greek alphabet.Henri's subject, Mlle. “X”, along with the Nabokovs, previously mentioned, had a colored Cyrillic alphabet.One acquaintance of mine, Suzan Akard, has an emerging colored Arabic character set based upon her colored Roman character set.Another acquaintance, Hua Min, has colored Chinese characters as well as a colored Roman set.Perhaps most interesting, Voss (1929) mentions a set of subjects, blind for various reasons but previously sighted, who, although blind, “see” before them or projected on a “screen” within their head, colored Braille letters.

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5. Conclusions

It appears that there are indeed trends for some, but definitely not all, graphemes and phonemes among synesthetes.The grapheme “A”, for example, is seen as red by such synesthetes far more than is statistically average, as is the phoneme [a].Now, in any set of data, there are bound to be anomalies and statistical quirks.One question, then, is whether the trends we see above for certain phonemes and graphemes are merely serendipitous and actually fairly meaningless.To me, such does not seem to be the case, particularly in regards to vowels.

Another, perhaps closely related question, is whether the trends seen above are the results of association, thus supporting “association” theories of causation for synesthesia.To this question, I can readily supply anecdotal information that would, I feel, suffice quite well to show that some colored-letter synesthetes most certainly developed their color-letter correspondence through association: some remember distinctly the items from which the associations derived, and some even have distinct repeating patterned sequences of colors that readily match household or classroom items from their childhood.On the other hand, for other colored letter synesthetes -- the large majority -- it appears quite evident that, if association did occur, it certainly was not via such simple sets of colored playing blocks or cut-out construction paper letters displayed in the classroom: no set of playing blocks would have four or five sequential letters all the same color, then a radical color shift for a single letter, then another set of three letters identically colored, and few if any schoolroom teachers would post up such a set.

This then raises the question of where such sets come from for those who did not obviously derive them from childhood objects.Are such correspondences neurological in basis for these synesthetes?It is my hope that my research helps towards answering this question by giving some indications of what to look for.For example, if we know that the grapheme “A” is most frequently red, and rarely purple, this might assist in pinpointing both the cause for correspondences made via association, and, for the other set of synesthetes, possible causes for correspondences made via neurological means. In consideration of sound symbolisms, the trends in colored vowel phonemes might be more directly useful towards exploring (world-wide?) neurological/cognitive trends in links between certain colors and speech sounds, and might be the better clue towards some of the neurological processes or wirings involved in colored-item synesthesiae.

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