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A Proposed Syriac Computer Keyboard Layout
George Kiraz

A

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A PROPOSED SYRIAC COMPUTER KEYBOARD LAYOUT

*By George Anton Kiraz
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With the rapid development of personal computers and their wide usage among scholars and common users, a few Syriac software programs (mainly word processors) have started to appear. These software programs are mainly designed to work with IBM-type personal computers and the Macintosh. The programs are designed by companies or individuals who saw that a need for Syriac software exists. Obviously, each programmer or designer needed a keyboard layout to implement the Syriac characters on the computer keyboard. As a result, a number of keyboard layouts appeared, each of them different from the other. Since the development of Syriac software is at its early stages, it would be wise to adapt a standard keyboard layout. It will be very difficult in the future to adapt one when a substantial amount of different layouts will be available.

Since Syriac is not an international language and its usage is rather limited, the task of standardizing a Syriac keyboard layout becomes more difficult. After all those who are going to use Syriac computer software are going to be either natives of the Syriac language and/or scholars. Some might be using it on a regular basis, while others on a limited basis. Some might prefer a phonetic layout, while others a layout based on the frequency of character occurrence. Some might be using another layout of a related Semitic language (say Hebrew or Arabic) and would rather have a similar Syriac layout. An additional problem is that some programmers or designers might implement contextual analysis in the software, where the program will automatically choose the shape of characters (stand alone, initial, middle or final); on the other hand, other programmers might use an ending common shape for all characters, while others might use all forms entered manually by the user. Our solution shall minimize this problem. Before proposing a Syriac keyboard layout, the following factors should be taken into consideration:

- The frequency of occurrence of characters.
- The frequency of characters with respect to other characters.
- The availability of contextual analysis.
- Placing characters to their corresponding phonetic keys.
- Minimizing the usage of shift, control and alternative keys.
- Taking into consideration other existing Semitic layouts such as Hebrew and Arabic.

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From these factors we determine that it is impossible to propose one layout to satisfy all the conditions; therefore, this proposal shall include two layouts: The first we shall call the Syriac Standard Keyboard Layout (SSKL), and the second the Syriac Phonetic Keyboard Layout (SPKL).

For the SSKL, the priorities of assigning characters to the keyboard keys are as follows:

- The frequency of occurrence of characters.
- The frequency of characters with respect to other characters.
- Minimizing the usage of shift, control and alternative keys.
- Taking into consideration other existing Semitic layouts such as Hebrew and Arabic.
- Placing characters to their corresponding phonetic keys.

For example, a character whose occurrence frequency is very high, such as *Alaph*, will be assigned a key in the center of the keyboard and not on the 'a' key. However, if the assignment of a character according to its occurrence frequency is close to another key which has its phonetic value, then the phonetic key will be assigned. For example, if *Semkath* has an occurrence frequency that places it on the 'd' key, it will be shifted one position to the left to be assigned on the 's' key.

For the SPKL, the priorities of assigning characters are as follows:

- Placing characters to their corresponding phonetic keys.
- Considering other existing Semitic layouts.
- The frequency of occurrence of characters.
- The frequency of characters with respect to other characters.
- Minimizing the usage of the shift, control and alternative keys.

For example, the letter *Alaph* will be assigned to the 'a' key, even if its occurrence frequency is the highest.

To study the character frequency, a program was designed to read Syriac electronic text files. The files included all the Syriac New Testament, a total of 637,164 bytes (464,615 Syriac characters). Two tables are listed in the appendix. The first gives the character frequency of Syriac letters in the entire New Testament. The second gives the frequency of Syriac letters with respect to other letters. Bar diagrams illustrate the character frequency.

From the first table, we notice that the vowel letters *Alaph*, *Waw* and *Yudh* have the highest frequencies. Out of the total number of characters in the files (464,615 characters), *Alaph* occurred 64536 times, *Waw* 47113 and *Yudh* 41762. As for the consonant letters, *Nun* has the

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highest frequency (44594 times), followed by *Lamadh* (34311 times). All other letters have frequencies lower than 30000. *Sadhe* has the lowest frequency (1514 times).

From the second table, we notice that the highest ten frequencies of letters with respect to other letters are as follows: *Yudh-Nun* 10193, *Waw-Nun* 9851, *He-Waw* 8890, *Lamadh-Alaph* 6660, *Taw-Alaph* 6249, *Nun-Alaph* 6130, *Waw-Alaph* 5425, *Alaph-Nun* 5341, *Lamadh-He* 5184 and *Mim-Nun* 4998. If we take a close look at these figures, we recognize that the noticeable high frequency of *Yudh-Nun* is affected by the high occurrence of plural personal pronouns (2nd feminine *antein*, 3rd feminine *enein* & *henein*), plural demonstrative pronouns (*halein* and *hanein*), the interrogative pronoun *aylein*, the 2nd and 3rd feminine suffixes of perfect verbs, the 2nd feminine suffix of imperfect verbs, and the objective pronominal 2nd feminine suffix *ken*. In a similar manner, we notice that the high frequencies of *He-Waw* and *Waw-Nun*, generating *He-Waw-Nun*, is affected by the high occurrence of the 3rd masculine pronominal suffix *hun*. Letters that constitute more than one word with different meanings, such as *Mim-Nun* in *man* and *men*, are also on the top ten list. In addition, the high occurrence of the 1st singular personal pronoun *ana* affects the frequency of *Alaph-Nun* and *Nun-Alaph*. The high frequency of *Taw-Alaph* is also affected by the feminine adjective suffix *ta*.

Keyboard diagrams, located in the appendix, present the proposed Syriac keyboards. The two keyboards assume the implementation of contextual analysis in the programs. If a certain program does not support this feature, it is recommended that the programmer designs the characters in such a way that one shape can be used for initial and middle and another shape for final and stand alone. In this case, the shift keys should be used for final and stand alone characters. For example, the *Beth* in the SPKL will have its initial and middle shape on the 'b' key and the final and stand alone shape on the 'B' key. In the case where all the shapes are implemented in the program and are entered manually by the user, it is recommended that the lower case keys be used for initial shapes, the shift keys for middle, the alternative keys for final and the control keys for stand alone (the latest design is not recommended).

In some cases a programmer might include two Syriac styles, say Estrangela and Eastern Syriac, in one font. The programmer in this case can use the lower case characters for one style and the upper case for the other style. However, including two styles in one font is not efficient in terms of programming and such design should be avoided. It is recommended that every

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software program include the three Syriac styles (Estrangela, Western Syriac and Eastern Syriac). The user should be able to switch between styles by a command (whether a key command or choosing an item from a menu). This way every character will have the same keys assignment in all styles. The *Alaph*, for example, will be assigned on the 'a' keys in the SPKL regardless of the style being used.

Vowels and diacritical marks can either be placed on the function keys or on the regular keys. If assigned to the regular keys, it is recommended that the vowels be placed on the shift keys of the corresponding phonetic value, for example *Fthaha* on shift 'a.' Another solution would be placing the vowels on five (or seven) adjacent shift characters. When assigning the vowels to the keyboard keys, it should be kept in mind that when the user inputs a fully vocalized text, the text should be entered first then the vowels should be placed. Typing text and vowels at the same time delays the speed of typing by a large factor.

As for the numbers and punctuation marks, they should be assigned to their corresponding keys on the keyboard. Traditional Syriac punctuation marks can be assigned to punctuation keys that are not used (such as < > | \ ~ etc.).

A final word about the two keyboard layouts presented in this paper, it is recommended that this Computer Conference studies the layouts thoroughly making the necessary modifications. Standardizing Syriac Keyboard layouts cannot be achieved without the input and cooperation of all participants.

It is hoped that this study will help to adapt standard Syriac keyboards for computer software.

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APPENDIX

FREQUENCIES OF SYRIAC LETTERS IN THE NEW TESTAMENT:

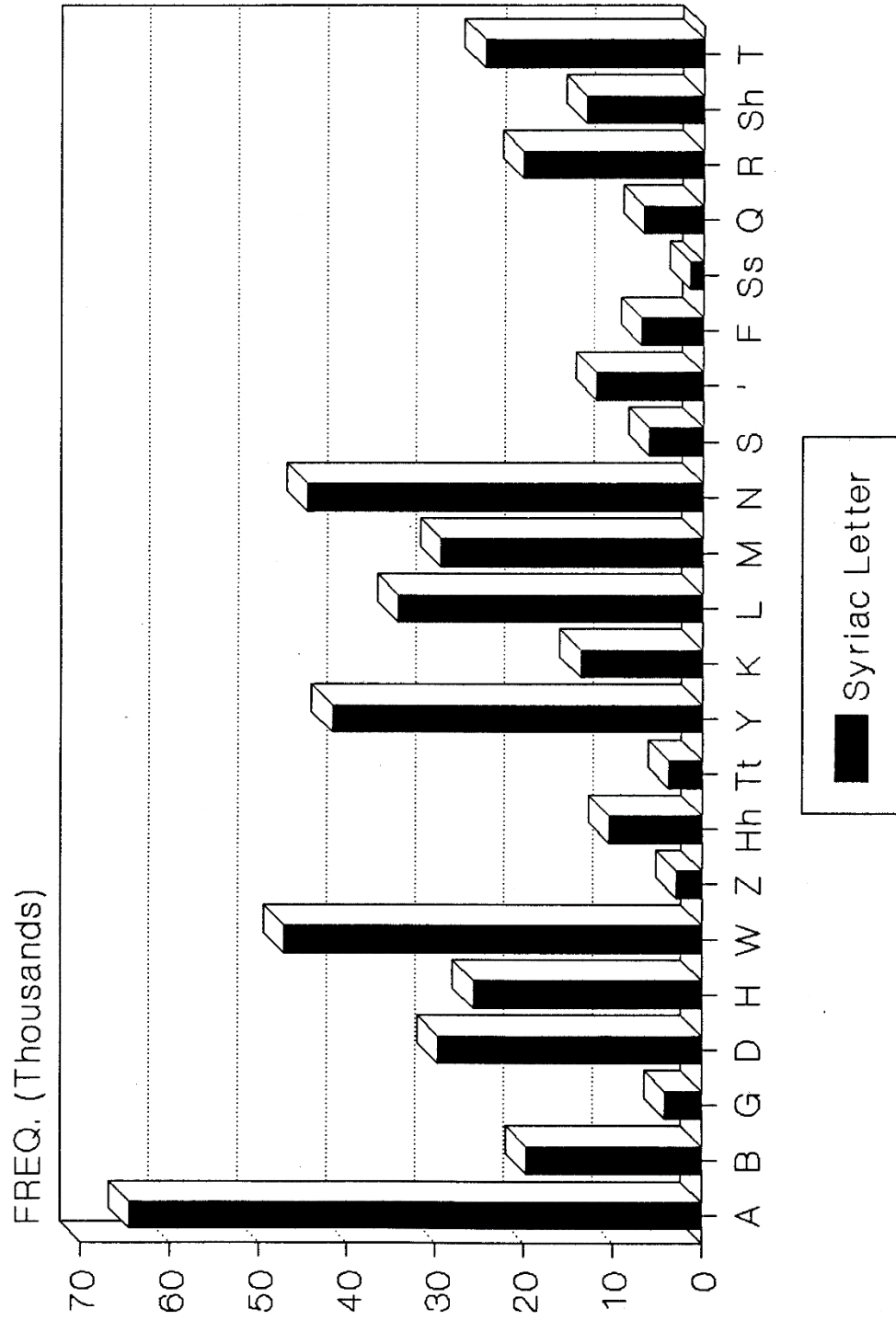
| | |
|----------|--------|
| Alaph: | 64536 |
| Beth: | 19750 |
| Gomal: | 4127 |
| Dolath: | 29761 |
| He: | 25765 |
| Waw: | 47113 |
| Zain: | 2890 |
| Heth: | 10478 |
| Teth: | 3807 |
| Yoodh: | 41762 |
| Kof: | 13725 |
| Lomadh: | 34311 |
| Mim: | 29519 |
| Nun: | 44594 |
| Simkath: | 6078 |
| 'E: | 11987 |
| Fe: | 6939 |
| Sodhe: | 1514 |
| Qof: | 6726 |
| Rish: | 20262 |
| Shin: | 13190 |
| Taw: | 24624 |
| TOTAL: | 464615 |

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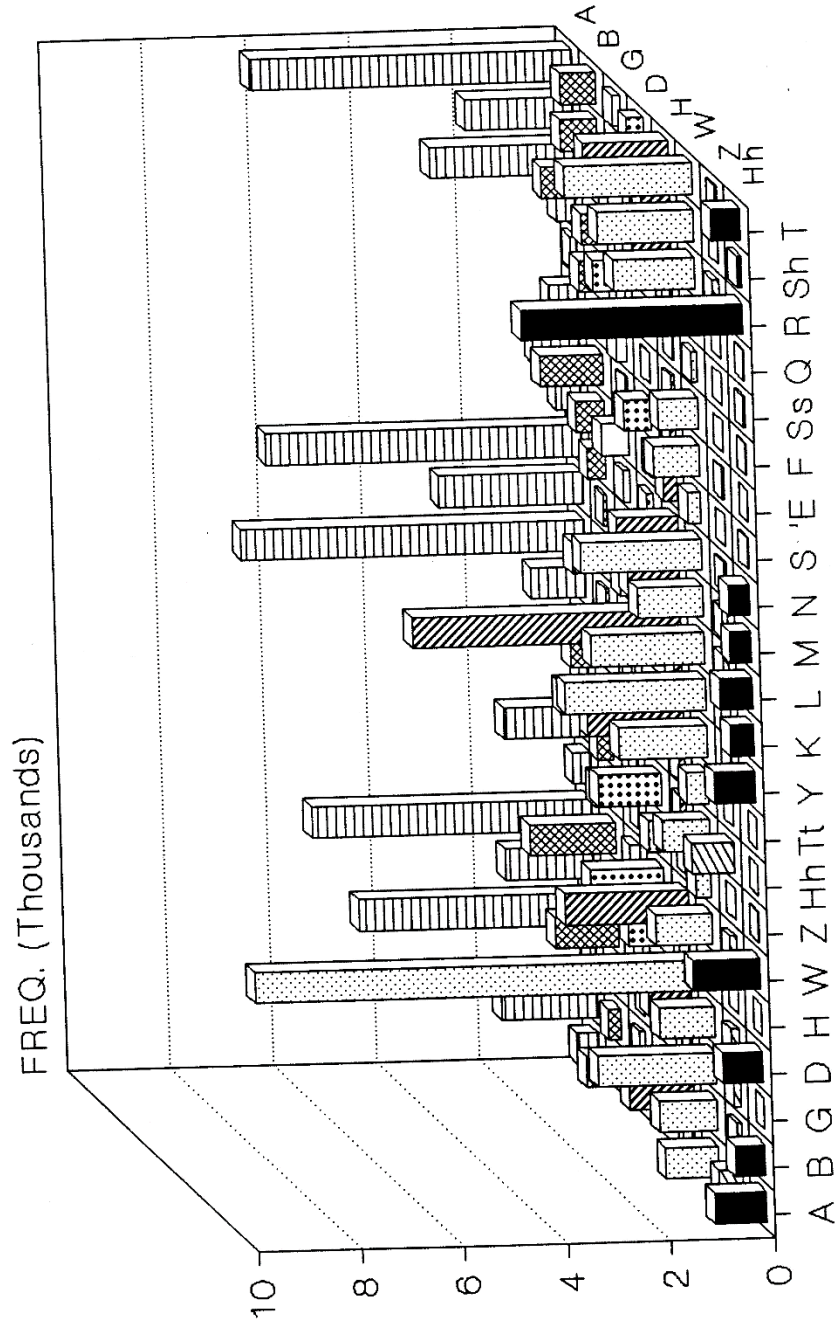
FREQUENCY OF OCCURRENCE OF SYRIAC LETTERS WITH RESPECT TO OTHER LETTERS

| | A | B | G | D | H | W | Z | Hh | Tt | Y | K | L | M | N | S | 'E | F | Ss | Q | R | Sh | T |
|---------|------|------|-----|------|------|------|-----|------|-----|------|------|------|------|-------|------|------|------|-----|-----|------|------|------|
| Alaph | 412 | 695 | 149 | 165 | 42 | 1016 | 453 | 1014 | 24 | 4197 | 555 | 2798 | 3091 | 5341 | 548 | 85 | 1327 | 38 | 132 | 824 | 601 | 2199 |
| Beth | 1851 | 246 | 100 | 1364 | 1236 | 1119 | 91 | 591 | 175 | 2510 | 678 | 745 | 527 | 1257 | 324 | 973 | 126 | 120 | 389 | 2366 | 532 | 958 |
| Gamal | 111 | 429 | 4 | 167 | 33 | 228 | 134 | 6 | 0 | 1675 | 0 | 520 | 145 | 111 | 1 | 22 | 13 | 0 | 0 | 372 | 28 | 57 |
| Dalath | 4574 | 1220 | 177 | 307 | 824 | 1075 | 157 | 790 | 111 | 4712 | 683 | 1422 | 3531 | 1723 | 297 | 1509 | 328 | 114 | 590 | 755 | 799 | 897 |
| He | 1703 | 500 | 27 | 724 | 20 | 8890 | 1 | 0 | 44 | 3633 | 563 | 690 | 94 | 1373 | 20 | 0 | 93 | 10 | 0 | 391 | 193 | 97 |
| Waw | 5425 | 1668 | 185 | 1425 | 2384 | 1100 | 123 | 1303 | 168 | 1255 | 1099 | 2383 | 2244 | 9851 | 1216 | 1669 | 366 | 78 | 854 | 1499 | 942 | 3597 |
| Zain | 340 | 383 | 15 | 281 | 34 | 300 | 3 | 25 | 4 | 435 | 63 | 464 | 34 | 76 | 0 | 87 | 4 | 0 | 82 | 147 | 0 | 31 |
| Heth | 1649 | 306 | 15 | 1228 | 104 | 920 | 813 | 0 | 321 | 1316 | 126 | 447 | 510 | 527 | 142 | 0 | 60 | 63 | 62 | 618 | 275 | 436 |
| Teth | 173 | 266 | 11 | 8 | 106 | 424 | 0 | 3 | 18 | 636 | 11 | 1092 | 39 | 261 | 7 | 143 | 81 | 0 | 3 | 313 | 27 | 35 |
| Yudh | 3376 | 789 | 63 | 1890 | 1846 | 1713 | 30 | 804 | 126 | 68 | 1896 | 2074 | 1656 | 10193 | 253 | 179 | 177 | 55 | 449 | 2082 | 1832 | 4386 |
| Kaph | 1052 | 81 | 0 | 1250 | 160 | 2719 | 2 | 475 | 0 | 974 | 43 | 2184 | 155 | 1124 | 231 | 0 | 123 | 0 | 0 | 497 | 59 | 491 |
| Lamadh | 6660 | 702 | 242 | 305 | 5184 | 2194 | 107 | 659 | 254 | 4229 | 2002 | 482 | 2860 | 701 | 119 | 541 | 655 | 126 | 294 | 93 | 253 | 1153 |
| Mim | 2796 | 70 | 95 | 1071 | 993 | 1266 | 99 | 422 | 946 | 2277 | 562 | 1741 | 436 | 4998 | 414 | 960 | 198 | 203 | 265 | 3869 | 1757 | 1412 |
| Nun | 6130 | 357 | 129 | 137 | 1182 | 2344 | 43 | 441 | 210 | 2027 | 389 | 36 | 321 | 1045 | 475 | 185 | 1003 | 92 | 294 | 104 | 1802 | 2495 |
| Semkath | 478 | 550 | 536 | 40 | 253 | 260 | 0 | 37 | 194 | 783 | 189 | 137 | 266 | 161 | 25 | 72 | 312 | 0 | 93 | 546 | 0 | 201 |
| 'E | 894 | 1232 | 45 | 546 | 97 | 893 | 37 | 0 | 31 | 1066 | 29 | 2390 | 1343 | 329 | 196 | 2 | 14 | 13 | 148 | 262 | 7 | 604 |
| Fe | 560 | 0 | 197 | 8 | 69 | 775 | 0 | 25 | 49 | 670 | 122 | 472 | 5 | 306 | 139 | 26 | 8 | 61 | 580 | 657 | 499 | 534 |
| Sadhe | 118 | 438 | 0 | 32 | 27 | 118 | 0 | 47 | 28 | 161 | 2 | 182 | 7 | 72 | 0 | 64 | 70 | 2 | 0 | 94 | 0 | 15 |
| Qaph | 380 | 364 | 0 | 1058 | 34 | 964 | 0 | 27 | 193 | 633 | 1 | 419 | 194 | 255 | 67 | 96 | 98 | 34 | 1 | 950 | 127 | 144 |
| Resh | 2799 | 1101 | 294 | 171 | 753 | 1583 | 128 | 429 | 109 | 3068 | 470 | 22 | 393 | 1048 | 180 | 818 | 52 | 83 | 190 | 144 | 446 | 876 |
| Shin | 2093 | 715 | 28 | 269 | 555 | 1874 | 0 | 98 | 48 | 1153 | 553 | 790 | 1477 | 307 | 0 | 227 | 167 | 0 | 209 | 626 | 11 | 1100 |
| Taw | 6249 | 695 | 155 | 335 | 1644 | 2492 | 39 | 590 | 89 | 1747 | 815 | 718 | 518 | 404 | 102 | 264 | 273 | 15 | 405 | 1266 | 320 | 682 |

Frequency of Syriac Letters

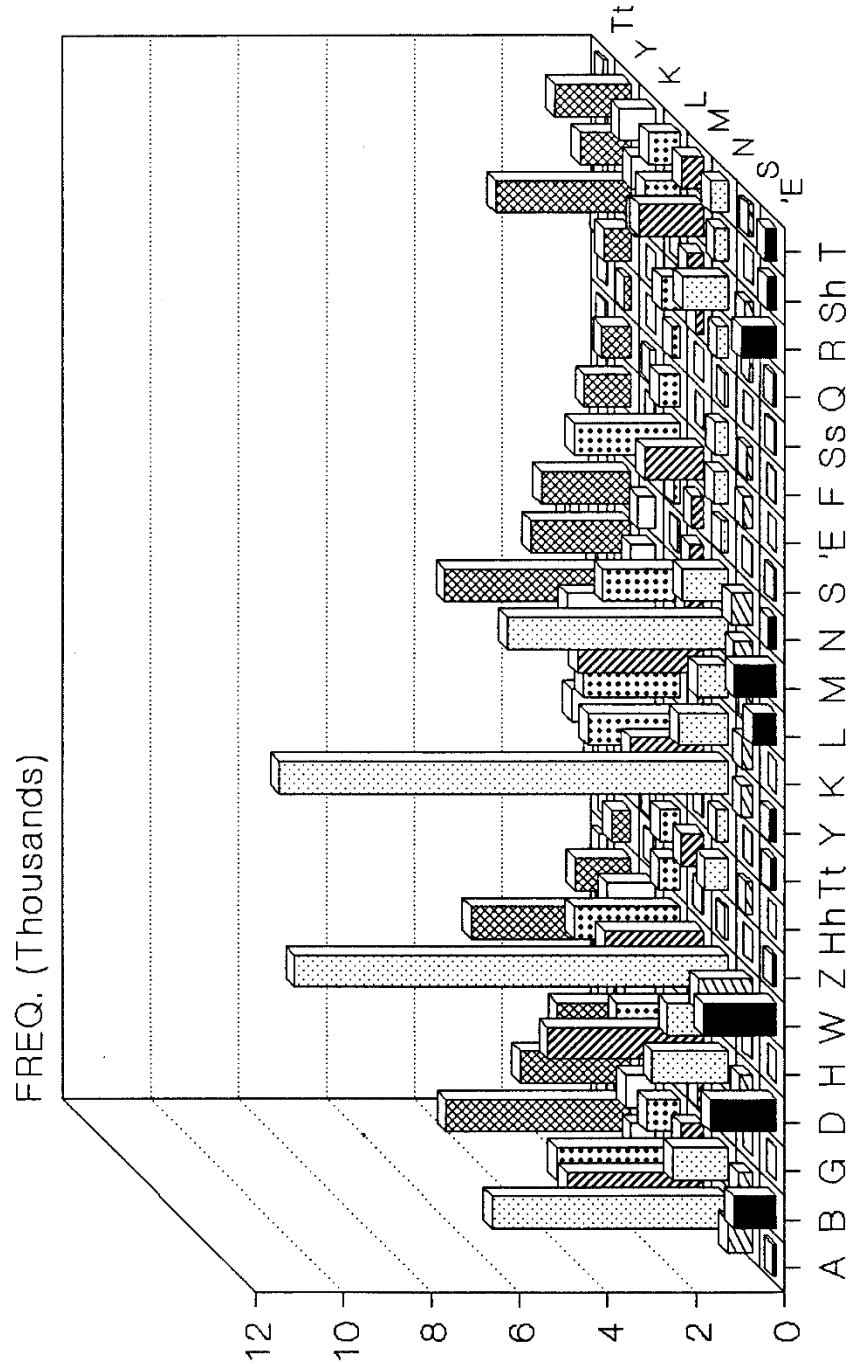


Frequency of Syriac Letters With Respect to Other Letters



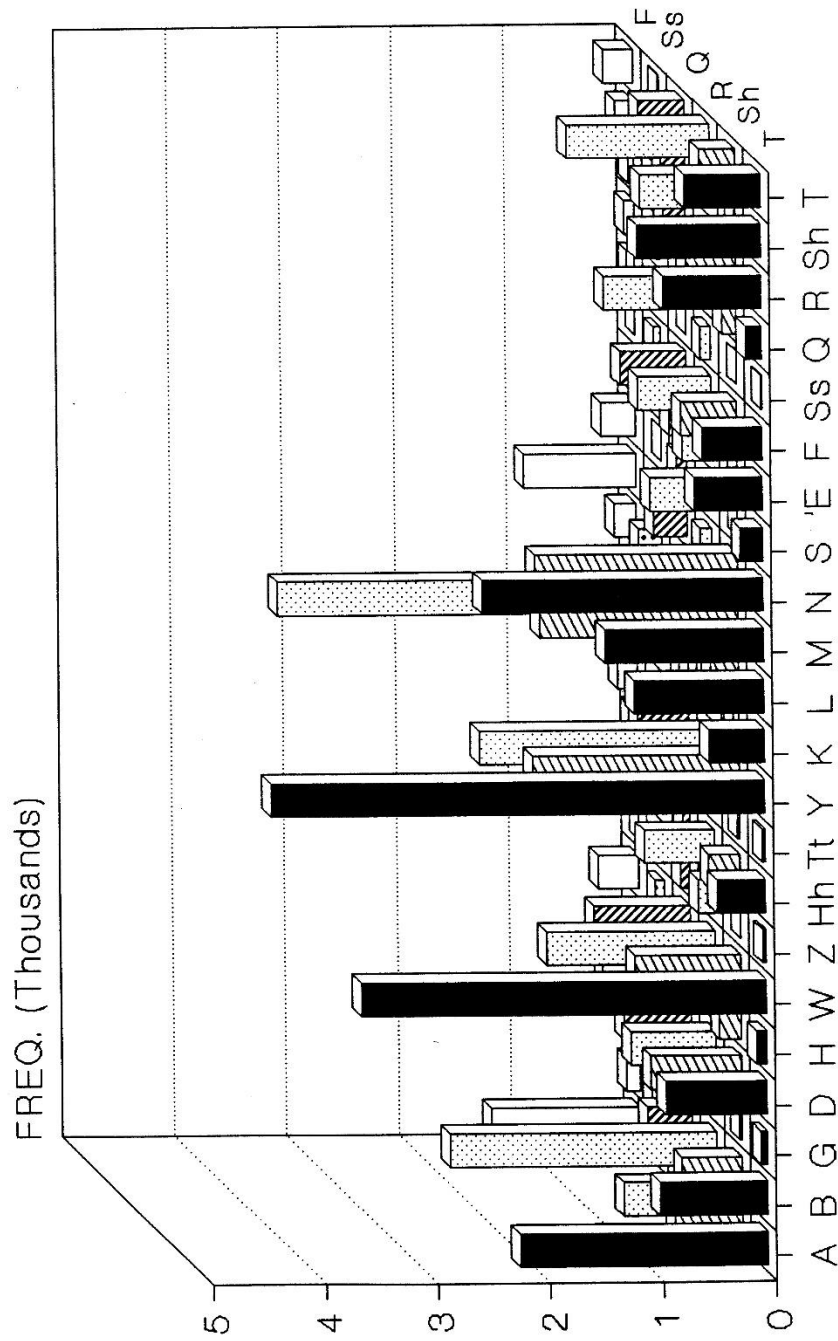
GRAPH 1 OF 3

Frequency of Syriac Letters With Respect to Other Letters



GRAPH 2 OF 3

Frequency of Syriac Letters With Respect to Other Letters



GRAPH 3 OF 3

