Arab Gulf J. Scient. Res., Math. Phys. Sci., **A5** (3), pp. 405-416 (1987)

Computer Arabization and the Need for Arabic Computer System Software Case Study: Kuwait*

Samir M. Kotob

Kuwait Institute for Scientific Research
P.O. Box 24885, 13019 Safat, Kuwait

ABSTRACT. The collective area of use, display, and processing of Arabic script by computer has been referred to as computer Arabization. This paper reviews the general requirements and constituents of Arabic computing.

To determine the need for special Arabic computer system software, a large user survey was conducted in the State of Kuwait. It addressed specific issues such as Arabic programming languages, Arabic operating systems, and Arabic application software. The outcome indicates overwhelming support for an Arabic programming language. The lack of Arabic application software was seen as the main obstacle to computer use in Arabic. There is great support for Arabization activities and efforts among all Arab users' groups.

The solution of problems related to using Arabic in computers has captured the interest of scientists and engineers for more than two decades (Hyder 1972, Ghazal 1980 and Kubba 1980). More recently, solving these problems has taken on a new level of interest as a result of the proliferation of microcomputers, in general, and personal computers, in particular. Techniques for using, displaying, and processing Arabic have appeared both in research laboratories and on a commercial scale, but more important, the interest in computers and Arabic has given birth to a new area of interest better known as computer Arabization. Issues dealt with in Arabization include Arabic programming languages, Arabic operating systems, and Arabic application software.

Several factors have affected computer Arabization. Primarily among these are the lack of basic researchs on Arabic computational linguistics and Arabic

* This paper resulted from a study entitled "Assessment of Arabic Computing" conducted in KISR in 1984. Kuwait Institute for Scientific Research. Publication No. KISR 1649, Kuwait.

phonetics. Arabization was also impeded by the lack of suitable hardware and software for Arabic language processing and the absence of a driving/motivating element for new developments in Arabic computers.

The aim of this study was to determine the effects of Arabization on the Arab user by determining users' perceptions of Arabic computing and their convictions about Arabization-related issues such as the need for Arabic programming languages operating systems, and features required in Arabic computers. The study is based on a survey of computer users in Kuwait (Kotob 1985a,b). The outcome of this study could help steer future research in computer Arabization and guide special computer developments in the Arab world for use in education, business and entertainment.

Previous Work

Computing in Kuwait and the Arab world has received some attention in the past few years. In 1978, a survey on computing in Kuwait was reported by Ali and Kotob (1978). In April 1981, the magazine *Arab Oil* presented computer vendor views on the Kuwait market. Also in 1981, Noor reviewed the problems facing computers users and provided a list of systems in use in Kuwait. An assessment of computer use appeared in late 1981 (Ibrahim *et al.*) that was based on a survey of 25 user sites. A recent meeting held in Kuwait by ECWA/KISR dealt with several issues related to computer Arabization, such as Arabic code standards and Arabic software (ECWA/KISR 1984). It must be mentioned, however, that none of the papers cited above dealt with the issues of Arabization and users' perceptions of most critical issues. None addressed the issue of Arabization, from either a technical point of view or its impact on computer users.

Requirements and Constituents of Arabic Computing

Several factors make Arabic computing (Mounajed 1983, Dewachi and 1980) significantly different from Latin (English) computing. Some of these differences, such as the Arabic character shapes, are obvious; some are major but not apparent. The constituents and requirements of Arabic computing include the following:

Arabic Input-Output

Arabic script is entered from right to left as opposed to the Latin.

Arabic text is not complete without the use of diacritics (vowel marks). The use of these marks is a function of the language morphology and are usually placed above or below all consonants.

Arabic letters are connected and have a more complex calligraphy than English letters. Moreover, the letters vary widely in shape with some that are very narrow and tall and *vice versa*. This, in addition to the diacritics, necessitates a very large character matrix size (24×24 or more).

Arabic letter shapes are determined by their position relative to other letters. Most letters have more than one shape. Some letters take as many as four.

Arabic Programming Language

A standard Arabic programming language that can provide at least some level of portability between computers, such as ANSI BASIC and FORTRAN 77, is required.

Presently, two BASIC-like Arabic computing languages are available. They are Al-Khawarizmi for the Al-Raed Arabic computer, and Najlaa, which are supposed to be UNIX compatible. These two have extremely limited distribution since they run on specific microcomputers.

Arabic Operating Systems

An Arabic operating system capable of handling English and Arabic files simultaneously is required. Currently, no Arabic operating system is commercially available.

The Al-Raed operating system may qualify as a full fledged operating system, since it is an Arabized form of CP/M 80, but it runs on the Al-Raed computer only.

Application and Utilities

Text editors, dictionaries and vowelization and facilities are all required for proper Arabic computing and text processing.

Methodology

Approach

The basic approach in this study is an exploratory survey aimed at determining the perception of users on what constitutes Arabic microcomputing and on the most common uses of Arabic microcomputers. The survey was geared to provide information on all factors that could contribute to the formulation of a position on Arabization. The analysis provides estimates of the magnitude or scale of a given factor and its priority. The analysis also attempts to draw a parallel between the user of the Arabic micro and the user of the Latin microcomputer. Finally, using statistical inference methods, the analysis provides explanations for factors that affected and will continue to affect the Arab user.

Questionnaire

The source of information for the survey was a specially designed questionnaire in Arabic. It assumes the respondent has some familiarity with computer-related terms such as hardware, software, programming language, operating systems and application software. The questionnaire consisted of the following four sections.

- General computer ownership and use questions.
- Questions for users of Arabic microcomputers.
- Questions for users of English microcomputers.
- General occupational questions.

Scope

The survey was aimed at computer users, computer specialists, and individuals interested in computers, in general, and microcomputers in particular. The survey was conducted in the State of Kuwait and responses of Arab speaking users were chosen in the sample. A detailed description of the sample is provided in the following section.

Target Population

To meet the objectives of the study, individuals with at least some familiarity with computers and their applications had to be identified. The natural choice in this case was the Arab computer user, the Arab system analyst, programmer, operator, professional, and, possibly, the hobbyist.

Sampling Method

It was decided that the best way to reach the user was through a mail campaign if a suitable mailing list could be found. A mailing list was developed from a list of visitors and staff of popular computer trade exhibition in Kuwait. This event is one of the best publicized events of its type. It is visited by most computer-oriented individuals, mainly from Kuwait and other Gulf countries.

General Characteristics

The general questions and biographical information sections of the questionnaire provided a profile of the respondents (Table 1).

User representation: Only one out of five respondents was representing the views of companies. The remaining were either presenting their views as home users or their professional views as individuals. Further understanding of this point can be derived from the type of use statistics provided in Table 1 (line 4).

Table 1. General Characteristics of Arabic Computer Users

Type of inquiry	Graphical representation	Category	%
Responding as individual or company	++++++++++++++++++++++++++++++++ ++++++++	Individual Company	80 0 20
Computer ownership	++++++++++++++++++++ ++++++++++++++++++	YES NO	53 45
Computer use	++++++++++++++++++++++++++ ++++++++++++	Users Nonusers	67 30
Type of use	++++++++++++++++ +++++++++++++ ++++++++	Home Office Others	43 35 22
Age	++ ++++++++++++++++++ ++++++++++++++ .	< 20 years 20-30 years 30-50 years > 50 years	5 52 41 2
Education level	+++++++++ ++++++++++++++++++++++++ ++ .	Post Grad'te Graduate High School Other	27 64 7 2
Monthly income in Kuwait Dinar*	+++ ++++++++++++ ++++++++++ +++++ ++++++++	< 250 KD* 250-500 KD 500-750 KD 750-1000 KD > 1000 KD	7.5 33 27 12.5 20
Type of organizational activities**	++++ +++++++++ +++++ ++++++++++++++++++ ++++++++	Industrial Commercial Financial Educational Services	10 23 13 50 20
Length of computer use in years**	++++++++++++++++++++++++++ ++++++++ ++++	< 5 years 5-10 years > 10 years	69 21 10

* 1 Kuwait Dinar = $ 3.5

** For Respondents from business

Computer ownership and usage: The computer ownership ratio of at least one-to-one between computer enthusiasts was not expected in Kuwait, or as a matter of fact, in any Arab country. In retrospect, however, we believe that this ratio will lend creditibility to the outcome of this survey in the sense that the respondents had hands-on experience with computers. Two out of three are presently using computers.

Biographical information: Ninety percent of the respondents were between 20 and 50 years old and hold university or post-graduate degrees.

Type of use: The majority of the respondents are in the commercial and business sectors.

Sample Size

The original mailing list included the names and addresses of around 2200 individuals. After editing to reduce any multi-entries, the final list was reduced to 1250. A total of 379 replies were received within six weeks after the distribution date. The return ratio was more than 30%.

The return rate was less than we expected because:

1. The list contained a large number of incomplete addresses.
2. The questionnaires were sent without prior knowledge on the part of the recipients.
3. Individuals were asked to complete a relatively lengthy questionnaire.
4. The concept of a mail survey in Kuwait is still new and uncommon. It is believed that this affected the response negatively.

Results

Arabic Programming Language and Operating System

There is a great debate surrounding the involved issues of having Arabic programming languages and an Arabic operating system, with two main points of views.

1. *Opposition to all Arabic programming languages and operating systems:* This was the prevalent view among computer enthusiasts prior to the rise of popularity of the personal computer. This view supported the idea that language standardization, programming language independence of national languages, and program portability across borders are more important than having computer applications written in an Arabic programming language.

2. *Support for Arabic Programming Language and Operating Systems:* This view was held by a minority of educators who felt that computer literacy will remain at very low levels when compared with those in other countries *e.g.*, in the USA and some countries of Western Europe, unless an Arabic programming language is developed for use in computer education. The premise here is that the foreign language used in most computer languages has acted as a barrier to most Arabs in learning computing. The position of this group has recently been strengthened by new trends in personal computing and the wide proliferation of home computers.

3. *Survey Outcome:* The survey leaves no doubt that an overwhelming majority (86%) believe that an Arabic computing language is necessary for arabic computing (Fig. 1). Nearly the same percentage of respondents were in favor of having an Arabic operating system. The fact that the majority supported the Arabic programming language came as no surprise. The unexpected outcome was the overwhelming amount of support.

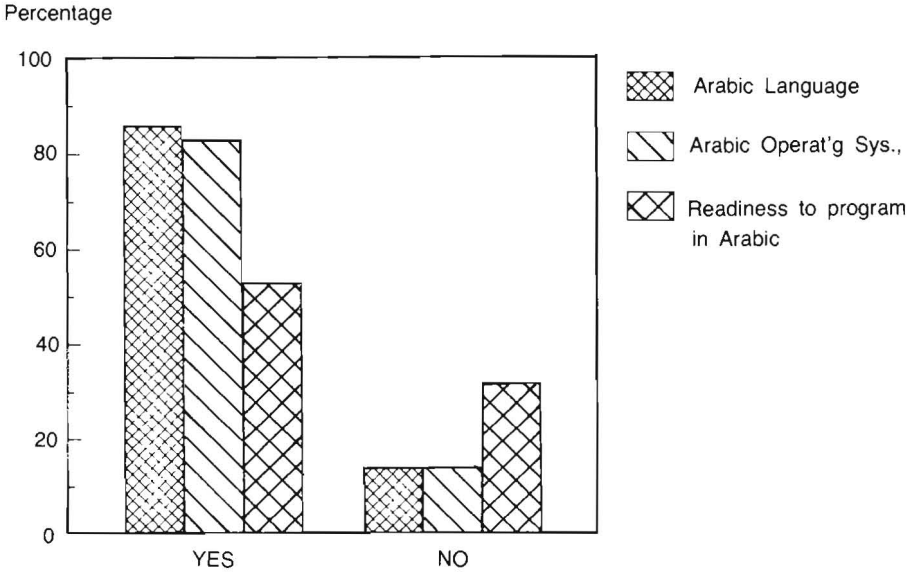

Fig. 1. Support for Arabic computing (Source: Kotob 1985b, p. 12)

The results also bring up an important issue, the willingness of computer users to program in Arabic. More than 50% did indeed express the willingness to switch from English to Arabic. Again, this result was not anticipated since it implied that a large percentage of Arab computer users are willing to program in an Arabic programming language (see Fig. 1). Nevertheless, about 30% of those supporting an arabic programming language were not willing to switch to Arabic. This point confirms the doubts expressed by experts on the ease of switching from programming in English to programming in Arabic. The results clearly showed that lack of willingness to switch to Arabic is a function of present computer use. Thus, responses indicated that Arabic programming language(s) will be used more by new programmers and users than by experienced ones.

Factors Affecting Computer Use

To determine the factors behind the relative lack of computer use in Arabic, users were asked to address the following points:

- Character shapes in Arabized computers (30%)
- Lack of diacritics in all commercially available Arabic computers (30%)
- Non-Arabic operating system (34)%
- Non-Arabic programming language (36%)
- Lack of Arabic software (64%)*
- Screen size in commercially available Arabic computers (6%)
- The need to switch from one language to another (20%).

These responses reaffirm that Arabization efforts must be geared toward solving basic problems in the development and widespread availability of Arabic software (Fig. 2). In this respect, it must be mentioned that the library of Arabic software is nearly non-existent. Companies providing Arabic capabilities have tried to supply some software, but it does not exceed, in most cases, ten titles. Al-Alamiah Electronics of Kuwait is a good exception to this point; it provides now more than fifty titles for its Arabized home computer MSX-SAKR. These are mostly educational in nature. These numbers should be compared to the thousands of titles presently available for popular micros such as the IBM-PC, Apple IIe, Commodore, and Atari.

In Business computing, very few software houses have included basic business software in Arabic in their offerings. Because of their limited support, program capabilities and versality, Arab users have opted mostly to stick to standard packages and productivity tools. The survey also revealed important new factors that are viewed as impediments to Arabic computer use, namely:

* This outcome is similar to that of a recent survey on use of micros in big U.S. firms (Data Decision 1983), where 65% rated lack of adequate software as the most important factor in computer use. We must caution, however, that the U.S. survey was in reference to business software.

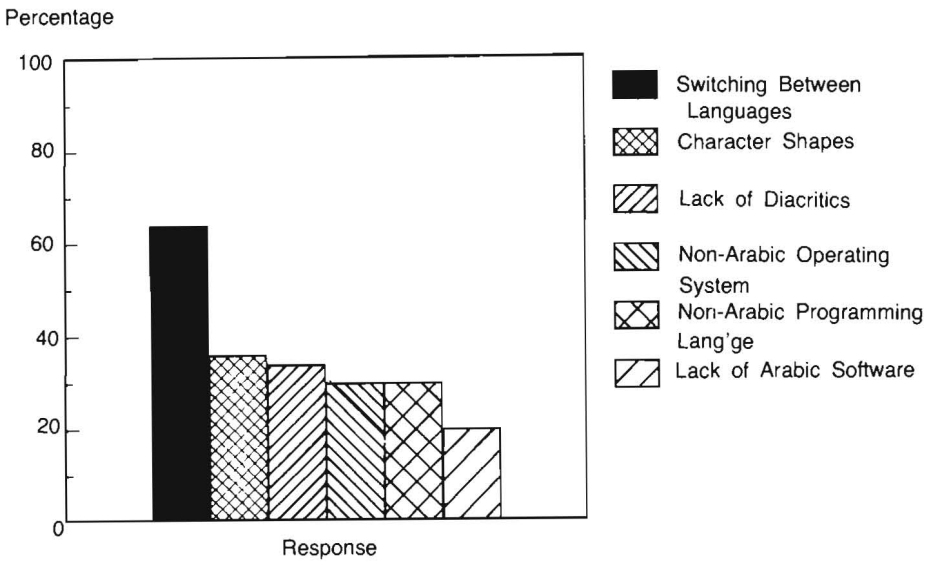

Fig. 2. Factors affecting Arabic computer users (Source: Kotob 1985b, p. 14)

- Lack of compatibility between Arabic computers.
- Lack of new program development software.

Profile of Arab Computer User

A profile of the Arab user of computers came through the survey. He is a college graduate that owns or intends to own his own computer. He has a good understanding of what is meant by an Arabic computer, but more important, he has a clear grasp of the weakness of such a computer, *i.e.*, lack of prepackaged software and stability of suppliers. Before using a computer, he perceived it as a means for education and word processing, but after using it, it became a tool for program development and information storage. Computers for education figured high on the list of uses.

Arab users are convinced that a bilingual or Arabic computer will be more useful and beneficial than an English one, notwithstanding the ease of use and improved productivity. To get the benefits of bilingual computers, users are willing to pay an average of about 25% more than for English computers. In fact, more than five to one stated that their computer in the future will be a bilingual one.

Professional Arabs, *e.g.*, engineers and some programmers, were the minority in their reserved support or opposition for Arabic computing. This may only be a sign that Arabization will always be challenged by a small group of professionals who are convinced that Arabization is no more than a manifestation of nationalistic sentiments expressed by an overly zealous and vocal minority.

Discussion

Several points emerged from this survey on Arabization and Arabic computers; we will focus our attention here on three:

1. The need for an Arabic programming language.
2. The need for prepackaged Arabic software.
3. Compatibility problems in Arabization.

It is evident that these points are closely linked and exemplify the challenge to Arabization. This is the challenge of developing a widely accepted Arabic programming language well suited for the development of a "good sized" Arabic software library that maintains some acceptable level of compatibility among systems of different architecture or design. We believe that this type of compatibility already exists in English with standard programming languages such as FORTRAN 77 and ANSI BASIC. In Hosni (1985), the general characteristics of an Arabic programming language was presented, including the special constructs required for processing the Arabic language. The question that still requires full attention is how to implement an Arabic programming language. Should it be a totally new language compiler or interpreter, or can it be realized using a pre- or post-processor to an existing language. This solution partially exists now with such a commercially available programming language as Al-Khawarizmi. We believe that this will continue to be the case for the short term. It is our conviction, however, that the best way to deal with the issue of national languages in the long-term is to have an independent programming language and a front end processor that can be tailored by the user. Such languages are in fact, being developed in some universities.

In Kotob and Hosni (1985) a list of needed application software was developed and classified by two classes of computers, personal and home. Primary among software listed were general productivity tools and educational and language processing software. The main difficulty faced by the Arab user and software developer is how to make a comprehensive library available when the user base in Arabic-speaking countries so much smaller than in English-speaking countries. This will be reflected by excessively high prices and a relatively small software selection. The best way around this problem we believe is a fairly liberal policy by software houses to provide access to the source of their programs for Arabization

in exchange for reasonable royalty fees. Otherwise, the present situation will continue as it is, making the Arab market unattractive to hardware producers and software houses alike.

Through the survey, we detected the emergence of new enthusiasm for computer Arabization. We feel that if this enthusiasm is matched by the computer system scientists and manufacturers, the final outcome will be rewarding to all sides.

Acknowledgements

This is to acknowledge the contribution of Dr. M. Atef in preparing the questionnaire and Ms. M. Elgayar in carrying out the statistical analysis.

References

Arab Oil (1981) *Special issue on selected aspects of computers in Kuwait,* April.

Ali, K.T. and **Kotob, M.S.** (1978) Computer utilization in Kuwait, Paper presented at *Kuwait National Symposium on Science and Technology for Development,* Kuwait Institute for Scientific Research, Kuwait, May.

ECWA / KISR. (1984) *Proceedings, Microelectronics and Informatics in the Arab Countries,* Kuwait, March 4-7.

Data Decisions (1983) Micros at Big Firms: A Survey, *Datamation* **29**(11): 161-174.

Dewachi, A. (1980) Considerations for the Implementation of an Arabic Code in Data Processing, *Proc. Intern. Symp. Standardization of Codes, Character Sets and Keyboards for the Arabic Language in Computers,* Saudi Arabia.

Ghazal, A.L. (1980) ASV-CODAR. *Proc. Intern. Symp. Standardization of Codes, Character Sets, and Keyboards for the Arabic Language in Computers,* Riyadh, Saudi Arabia, pp. 961-965.

Hosni, Y. (1985) Programming languages for Arabic applications. *Paper presented at the ECWA Workshop on Computer Processing of the Arabic Language,* April 14-16, Kuwait.

Hyder, S. (1972) A System for Generating Arabic-Farsi-Urdu Script, *Information Processing* **71:** 1114-1119.

Ibrahim, R., El-Gayar, M. and **Jafar, F.** (1981) *Computer Usage in the Gulf, Case Study Kuwait,* Kuwait Institute for Scientific Research, Report No. KISR464, Kuwait.

Kotob, S. (1985a) *Arabic Microcomputers: An assessment (ASD-7),* Kuwait Institute for Scientific Research, Report No. 1685, Kuwait.

Kotob, S. (1985b) *Users Perception of Arabic Computing: A Survey (ASD-7),* Kuwait Institute for Scientific Research, Report No. KISR 1649, Kuwait.

Kotob, S. and **Hosni, Y.** (1985) Assessment of Microcomputer Arabization Efforts. Paper presented at the *ECWA Workshop on Computer Processing of the Arabic Language,* April 14-16, Kuwait.

Kubba, G.A. (1980) The impact of Computers on Arabic Writing, Character Processing, and Teaching, *Information Processing* **80:** 961-965.

Mounajed, M.B. (1983) *Use of Arabic Script in Computers and Communication Media,* Lecture presented at Arab School on Science and Technology, Morocco, pp. 135-143.

Noor, A. El-Sayed (1981) Computing in Kuwait, *Datamation* **27**(13): 157-160.

(Received 18/03/1986;
in revised form 17/08/1987)

تعريب الحاسوب الآلي والحاجة إلى نظم البرمجة العربية
درس حالة: الكويت

سمير قطب

معهد الكويت للأبحاث العلمية ـ ص. ب ٢٤٨٨٥ ـ الصفاة ١٣٠١٩ ـ الكويت

لقد عرفت مجموعة النشاطات المتعلقة باستعمال وعرض ومعالجة النصوص العربية في الحاسوب الآلي بالتعريب. وتسعى هذه الورقة لتستعرض متطلبات ومركبات التعريب. وليتم التعرف على الحاجة لمكونات البرامج باللغة العربية فقد تم القيام بمسح ميداني في دولة الكويت حول جوانب من التعريب كلغات البرمجة ونظم التشغيل وبرامج التطبيقات العربية. وقد عكس المسح مجموعة كبيرة من المهتمين باستعمال الحاسوب والاخصائيين. وتشير النتائج إلى وجود تأييد عارم للغات البرمجة ونظم التشغيل العربية حيث أن أكثر من خمسين بالمائة أعربوا عن استعداداهم للتحول إلى البرمجة باللغة العربية. إلا أن نقص برامج التطبيقات العربية أعتبر العقبة الرئيسية التي تعيق إنتشار الحاسوب العربي. كما ظهر وجود تأييد واسع لجميع أوجه النشاط المتعلقة بالتعريب من جميع المستفيدين من الحاسوب العربي.