

LINGUISTIC OBSTRUCTIONS TO SCIENTIFIC INFORMATION IN HIGH TECHNOLOGY AREAS

By Jagdish C. Agrawal and Saud Al-Mathami

Abstract: The rapidly advancing high technology area of Computer Science is dependent on language dependent tools and techniques. The literature for these tools and techniques is overwhelmingly concentrated in English. Well recognized bodies that make standards for these tools and techniques (ANSI, ISO, etc.) are heavily influenced by English. Third world countries that import these tools and technology as part of their technology import program face a large problem of technology transfer: training. Third world countries, where English is not the first language, the methods to filter and control the potentially unlimited flux of information must include methods to deal with the language issue. Universities like ours, are, through their faculty research and development are contributing heavily towards developing the methods to deal with the language issue. Our Computer Science degree programs have an active track in Arabization. Our student projects in overwhelming numbers concentrate on Arabization. At R&D level, our faculty colleagues actively pursue research in Arabization. Private industry is also contributing to this effort by offering tools and techniques (Arabic Windows, WYSIWYG Word Processors, Spread Sheets, Database Management Systems, etc.) There is also an effort for developing Standards for this Arabization. However, the solutions that we share with the reader of this paper are localized solution at the national level and do raise issues of portability, interoperability, etc. across national boundaries. There is a need to have "multi-lingual" tools and techniques as well as standards for a better solution, and the third world countries ought to collectively look at them. These needs are also discussed in the paper.

1. Introduction

In a recent paper, Belkin and Croft¹ discuss some important concerns about the importance of information and making it available to its receiving end users:

"The promise of the information age entails making information available to

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people any time, any place and in any form. Realizing such a promise depends on innovations in areas that impact the creation of information service and their communication infrastructures. However, this realization can easily become a mixed blessing without methods to filter and control the potentially unlimited flux of information from sources to their receiving end-users."

Emerging new technologies in this information age are making a significant impact on the society as well as on the organizations within a society. As pointed out by Samarajiva², in developing nations in particular, external communication is essential to productive scientific activity. The external communication with the sources from where the technology is being imported or transferred must overcome any linguistic barriers. The literature for the technology being imported or transferred in to a third world country is overwhelmingly concentrated in English. Third world countries that participate in a technology import program face a large problem of technology transfer: training. Third world countries, where English is not the first language, the methods to filter and control the potentially unlimited flux of information must include methods to deal with the language issue.

2. Barriers to Technology Transfer to the Third World

Let us first examine what barriers to technology transfer to the third world countries have been identified by previous researchers and how does the language issue rank among these barriers. Al-Tayyeb³ wrote a Ph.D. dissertation on the subject of information technology transfer to Saudi Arabia. As part of his research, Al-Tayyeb identified several socio-cultural and technical barriers to successful information technology transfer to developing nations such as Saudi Arabia. Socio-cultural barriers included communication between vastly different societies in terms of culture and religion. Since languages are to some degree closely inter-mixed with the culture, linguistic barrier was to a partial degree identified. However, we will go into the linguistic barriers in detail.

In a recent paper, Al-Tayyeb and Wrenn⁴ identified an important barrier:

"The lack of internationally accepted standards can also be a barriers to effective transfer of technology."

We feel that if the language in which the training material, support material, and standards for the technology being transferred are expressed is a foreign language to the country importing the technology, then the language can be the a larger barrier, because it will be the first barrier.

Mandurah and Bakri⁵ surveyed the methods and techniques utilized to measure the transfer of information technology in the light of science and technology indicators. They suggested that such indicators should include: measurement of the use of computer literacy, measurement of the attitude towards computers, survey of applications of information technologies, and the influence of information technologies on productivity. The relative ease in transferring the emerging technologies could be visualized by combining the socio-technical barriers in a matrix. While such a visualization is subjective in nature and far from being quantitative, this approach allows one to see the relative strengths and weakness (in terms of transferability) of multiple technologies. Under the approach of Mandurah and Bakri, e-mail and Arabic computers were placed on the low end of the barriers line, while AI systems were on the high end. Our thesis is that e-mail users have reached a level of comfort in English, that they did not find difficulty in its use, and hence the low end placement of e-mail. AI systems required heavy use of English by users who were not as comfortable with it as the e-mail users.

3. Factors to Enhance the Success of Technology Transfer

Rogers⁶ found five factors in the successful transfer of technology:

- i. Relative advantage compared to existing technologies in terms of price, performance, capabilities, reliability etc.
- ii. Compatibility between existing technologies and the new technology in terms of interfaces etc. Language will play a very important role here for the interface, if in the past there was little or no dependence on English for performing the tasks that will now be performed with the new technology.
- iii. Complexity in terms of usability, maintainability, skills needed, training needed, etc. Language would play an important role here, if in the past the same work was being done without much English.
- iv. Observability of results by the end users is important to assess the success of the technology transfer.
- v. Trialability meaning that it is easier to abandon a technology after trying it, if the benefits expected do not occur.

Going over the success factors, we find the language playing an important role as pointed out above in the factors 2 and 3 above. One factor that needs to be added to the above list is the impact of the new technology on the importing nation's trade. Software Engineering technology transfer to India has shown its greatest payoff in increased trade and from the fact that many leading Software manufac-

turers have opened Software factories in India now because of availability of cheaper and highly qualified skilled labor for these factories.

4. Some Localized Solutions to Overcome the Barriers

Saudi Arabia is a big importer of the information and computer technology. The official language here is Arabic, and English is not the first language. Therefore, universities like ours, did, through their faculty research and development contribute heavily towards developing the methods to deal with the language issue. Our Computer Science degree programs have an active track in Arabization. Our student projects in overwhelming numbers concentrate on Arabization. At R&D level, our faculty colleagues actively pursue research in Arabization. Private industry is also contributing to this effort by offering tools and techniques (Arabic Windows, WYSIWYG Word Processors, Spread Sheets, Database Management Systems, etc.) There is also an effort for developing Standards for this Arabization.

As examples of the numerous student graduation projects and graduate theses related to the Arabization effort, we will cite some work to give the reader an idea about this effort. A team of three graduating seniors: A.G. Al-Tamimi, A.M. Al-Hedaithy, and I.A. Abu-Abat, as part of their graduation project under the guidance of Dr. Mohammed El-Affendi developed an Arabic WYSIWYG (What You See Is What You Get) Tool for Desktop Publishing⁷. Desk Top Publishing (DTP) and Word Processing (WP) software with graphic user interfaces was attracting a lot of attention, but its use in Saudi Arabia could be fruitful only if it provided Arabic interface. The major objective of this project was to design a WYSIWYG tool so that the user could write documents, edit them, print hard copies without any English.

Another example of such a useful project arose from the need of our College's Research Center (RC). RC receives many Arabic documents, letters, and reports on a daily basis there was no automated way of keeping track of these documents. Two graduating seniors, Omar Al-Sheikh and Abdullatif Al-Sheikh, under the guidance of Mr. Badiuddin Syed designed and implemented a DTS-Documents Tracking system⁸, using Mussaed's Alarabi as an interface for Arabization.

In scientific and business environments, writers often need to produce diagrams, charts, and shapes to be included in their work. Most of the available drawing, charting, and shapes producing graphic programs operate in Latin mode only. This isolates the Arabic author from the features provided by a high-tech graphic program. Thus a group of two graduating seniors: Abdulrahman A. Al-Borai then and Ahmed A. Al-Dayel, under the supervision of Dr. Mohammed El-Affendi

proposed and completed a project entitled: "Developing an Arabic Tool for Composing Diagrams and Graphic Shapes from Primitive Shapes,"⁹. In the project, these students designed and implemented drawing package that allowed the user to produce diagrams composed of simple primitives using simple script Arabic language. The diagrams included trees, flow charts, networks, graphs, etc. The Arabic script language was the main interface between the user and the package, and it freed the user from dependence on English.

However, the solutions that we have mentioned above are localized solution at the university level, and there are some similar projects at the national level. These projects do raise many issues including:

1. Resource limitations of the country trying to overcome linguistic barriers.
2. Export-import limitations in the efforts to overcome linguistic barriers.
3. Lack of portability, and interoperability, across national boundaries obstructing efforts to overcome linguistic barriers.

5. Overcoming Resource Limitations

Many of the third world countries have severe resource limitations. Sometimes, political decisions within a country may lead to severe deterioration of its currency as happened recently in Mexico. Resource limitations is one of the most difficult problems to solve. This requires serious efforts by the governments of these countries. They need to give extremely high priority to research and development by their educators and give liberal grants and awards for such effort, as the National Science Foundation and many other organizations in the U.S.A. do. Large corporations of the west that are most likely to benefit from NAFTA (North American Free Trade Agreement) and GATT (General Agreement on Tariff and Trade), need to examine the possibilities of developing similar programs, which will have big pay-offs for them.

6. Overcoming Export-Import Restrictions

NAFTA (North American Free Trade Agreement) and GATT (General Agreement on Tariff and Trade), were designed to overcome the export controls of the advanced nations, and in particular, those of U.S.A., and the import restrictions in various third world countries that create a significant challenge restricting information technology transfer to the third world countries. Hopefully, NAFTA, NAFTA and GATT will bring big rewards. But until that happens, the governments of these countries need to encourage imports by their citizens at their own cost of information technology tools and techniques duty free, provided these tools and techniques are imported for training, research and development. The

benefits from such relaxation of policy will far outweigh the revenue lost by eliminating import duty on these items.

7. Overcoming lack of portability, and interoperability across national boundaries

There is a need to have "multi-lingual" tools and techniques as well as standards for a better solution, and the third world countries ought to collectively look at them. There has been little effort world-wide to meet these needs. We believe that because of the economic interests, the third world countries will have to take initiatives in this regard. Many good quality software tools are giving a limited choice of script, rarely if ever including a script of a language from a third world country. We hope that this will change. Right now, almost every country that is having software tools developed in its native language, is developing its own standards (or in some cases, different vendors are forcing their own standards) and when a software tool needs to be taken from one environment to another, lack of standards require very expensive redesign and reimplementations of the tool. For a reader not familiar with the software standards, think of the electrical outlets. Throughout the U.S.A., there is a common standard of two-prong outlets for non-grounded, and three-prong outlet for grounded electrical connection. However, in Saudi Arabia, there are about a dozen different type of electrical outlets, and therefore, a family that buys an electrical appliance has to devote some time and money hunting for the right converter to connect the appliance to the outlet available in their house, and in many cases also buy a voltage converter as well, because both 220-V and 100-V appliances are sold and some houses have 100-V outlets, other have 220-V outlets (some have both). Software technology requires uniform standards, so that the software tools can be easily ported from one environment to another just like we can take a shaver on our travel and be confident of being able to plug it in any hotel's electrical outlet.

8. Conclusions

This paper we have presented problems related to information technology (IT) transfer to the third world countries such as self-dependence in (IT), linguistic obstruction, etc. We proposed possible solutions of these problems, and gave examples how these problems are being tackled in under-developing and developing countries such as Saudi-Arabia.

9. References

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Jagdish C. Agrawal
Saud Al-Mathami
College of Computer and Information Science
King Saud University
P.O.Box 51178
Riyadh - 11543
Saudi Arabia