CEN/TC304 N966
Subject/Title: Cultural Diversity Market Study, draft final report
Source: Makx Decker (PriceWaterhouseCooper)
Date: 15 February 2001
Action/Note: This document will be validated in an open meeting 22 Feb in Brussels, it is also presented to TC-304 members and will be discussed in the plenary meeting 23 February. Assessment and recommendations related to the work of TC304 is not included in this document, but will be presented in a separate document.

PRICEWATERHOUSECOOPERS

Cultural Diversity Market Study

Draft final report

Luxembourg, 14 February 2001

Table of contents

Executive summary

Context

Since 1992, the European Committee for Standardization (CEN) has been engaged in a number of activities in support of cultural diversity. Initially the emphasis has been on standardisation in the field of information technologies as applied to character sets and other such cultural elements, to ensure that European localization requirements are satisfied. The work has been in the areas of identification, manipulation and coded representation of character data and its input, interchange and rendition by electronic means.

The most recent phase of this activity was established in a programme of work in 1997, which was supported by the European Commission by contract BC/CEN/97/26. The work was entrusted to CEN Technical Committee TC304 (Information and Communication Technologies - European Localization Requirements) and later some items were transferred to a number of Open Workshops under the CEN Information Society Standardization System (CEN/ISSS). This programme is nearing finalisation.

In view of the developments in the market (and in particular in relation to the emergence of the Information Society) the Commission believes that it is opportune to review the strategic business requirements for preparing consensus-building activities in support of a multi-cultural and multi-lingual Information Society.

This has to be seen in the context of the eEurope initiative launched in December 1999, which aims at accelerating the uptake of digital technologies across Europe and ensuring that all Europeans have the necessary skills to use them. eEurope feels that global issues increasingly demand global response, and that is the reason that there is a strong need for a collective European approach. Globalisation, enlargement and internationalisation are keywords in eEurope. This requires consideration of the cultural and linguistic diversity of Europe, thereby giving equal chances to all businesses and citizens in Europe to benefit from the Information Society.

Approach

In this environment, the Cultural Diversity Market Study, conducted by PricewaterhouseCoopers Consulting in Luxembourg, aims to formulate a set of conclusions and recommendations for consensus-building activities in Europe through a review of business requirements related to localisation or internationalisation of IT-based products and services.

The study distinguishes six areas of interest related to Cultural Diversity:

- Infrastructure aspects (fixed and mobile telecommunications infrastructures and connection policies, network protocol and mark-up language internationalisation);
- Input/output aspects (keyboards, character sets, ordering, sorting, data formats);
- Linguistic aspects (translation, writing style);

- Design and content aspects (look-and-feel, localised content);
- Commercial aspects (branding, marketing, communication, client services, pricing, payment mechanisms);
- Legal aspects (applicable law, consumer protection, privacy, liability, complaints)

The study is conducted in two parallel tracks: one to investigate what standardisation bodies, such as the International Organization for Standardization (ISO), the World Wide Web Consortium (W3C) and CEN have done in recent years, and the other to collect opinions from the market (content and service providers, software developers, hardware vendors, localisation industry, researchers and consumers). In these two tracks, correspondents representing a range of interests participate through e-mail questionnaires and interviews.

Conclusions

On the highest level, three main conclusions are emerging from the investigations:

1. **There is a lack of awareness of the importance of cultural diversity and of the potential of consensus building activities to solve problems in this area.** Cultural diversity is not an issue that is high on the agenda of European industry and consumer organisations. Many companies and organisations are involved in localisation activities but the issues are often handled in an ad-hoc and relatively unstructured way. It is not clear to industry how standardisation can help in solving problems they do identify in localising products and services, although a number of issues are identified where consensus building could help in finding solutions.

2. **Cultural diversity is addressed mainly from a technical perspective with no quantitative picture of costs and benefits.** In European industry, the contact for localisation issues is usually located in the technical departments where in US companies the marketing or international business development department is the main point of contact. Although it is recognised that localisation is beneficial to users and customers, there is no clear picture of the commercial benefits of localisation based on quantitative data.

3. **There is a need for co-operation in an international environment and with industry.** As cultural diversity is fundamentally global, a European perspective in standardisation and best-practice building needs to take into account the wider picture and activities should be undertaken in co-operation with international fora such as W3C and ISO. Co-operation with industry platforms such as the Localization Industry Standards Association (LISA) will ensure industry input, at the same time establishing channels for dissemination and take-up of the results.

Recommendations

Based on the conclusions of the study, the following recommendations are formulated:

The European Commission should:

1. In the framework of the eEurope and eContent initiatives, conduct a publicity campaign to raise the awareness of localisation issues in European industry and consumer organisations, supported through studies into costs and benefits of localisation in Europe and through information services publicising best practice examples;

2. Establish or support a portal service for information on cultural and legal issues related to cross-border e-business (both digital and tangible products), documenting cultural diversity in Europe as a whole and the individual European countries, as a reference source for industry;

3. Create a specific cluster activity in the eContent or the Information Society Technologies (IST) programme to develop best practice guidelines for quality control aspects in localisation and translation processes.

CEN should, on a strategic level:

1. Conduct a publicity campaign creating greater awareness in European industry on the market approach to ICT standardization that CEN has developed in recent years in CEN/ISSS, publicising results and highlighting benefits for industry of involvement in CEN/ISSS activities;

2. Establish a CEN/ISSS activity to co-ordinate work in the area of cultural diversity, map the various activities in standardisation around the world related to cultural diversity, and reinforce or establish liaisons with the major international platforms to ensure global synergy with proposed future CEN/ISSS activities;

3. Build strong links with LISA and other industry platforms to ensure input from industry and create a platform for dissemination and take-up of the proposed CEN/ISSS activities.

CEN/ISSS should, on a practical level:

1. In co-operation with LISA, establish a Workshop to define extensions that can be added to various XML formats to incorporate support for localisation and translation tools;

2. In co-operation with the IST sector of Human Language Technologies (HLT) and the eContent programme, establish a Workshop concerning exchange formats for vocabularies and investigate the possibilities to establish a Workshop on standardisation of speech recognition technologies;

3. Establish a Workshop to collect experience and prepare and disseminate guidance material for implementation of the Universal Multi-byte Coded Character Set (UCS, ISO/IEC 10646) in back-end systems and databases;

4. Ensure the explicit inclusion of cultural diversity aspects in current and future activities in the CEN/ISSS Electronic Commerce Workshop and other Workshops related to Information Society Technologies.

Validation and next steps

The conclusions and recommendations have been validated in a panel meeting on 25 January 2001 in Brussels with the following participants:

- Michael Anobile, Localisation Industry Standards Association, Switzerland
- James Boyd, CEN, Belgium
- Erkki Kolehmainen, TIEKE, Finland
- Anne Lehouck, European Commission DG Enterprise, Belgium
- Rose Lockwood, BerlitzGlobalNet, UK
- Gregor Thurmair, Sail Labs, Germany
- Marc de Vries, PricewaterhouseCoopers, Netherlands

And the study team:

- Makx Dekkers, PricewaterhouseCoopers, Luxembourg
- Robbert Fisher, PricewaterhouseCoopers, Netherlands

The draft final report will be presented in an Open Meeting on Standards and Cultural Diversity organised by CEN/ISSS in Brussels on 22 February 2001. The final report will be available for public distribution in March 2001.

1. Context and scope

Since 1992, the European Committee for Standardization (CEN) has been engaged in a number of activities in support of cultural diversity. Initially the emphasis has been on standardisation in the field of information technologies as applied to character sets and other such cultural elements, to ensure that European localization requirements are satisfied. The work has been in the areas of identification, manipulation and coded representation of character data and its input, interchange and rendition by electronic means.

The most recent phase of this activity was established in a programme of work in 1997, which was supported by the European Commission by contract BC/CEN/97/26. The work was entrusted to CEN Technical Committee TC304 (Information and Communication Technologies - European Localization Requirements) and later some items were transferred to a number of Open Workshops under the CEN Information Society Standardization System (CEN/ISSS). This programme is nearing finalisation.

In view of the developments in the market (and in particular in relation to the emergence of the Information Society) the Commission believes that it is opportune to review the strategic business requirements for preparing consensus-building activities in support of a multi-cultural and multi-lingual Information Society.

This has to be seen in the context of the eEurope initiative launched in December 1999, which aims at accelerating the uptake of digital technologies across Europe and ensuring that all Europeans have the necessary skills to use them. eEurope feels that global issues increasingly demand global response, and that is the reason that there is a strong need for a collective European approach. Globalisation, enlargement and internationalisation are keywords in eEurope. This requires consideration of the cultural and linguistic diversity of Europe, thereby giving equal chances to all businesses and citizens in Europe to benefit from the Information Society.

The objective of the Cultural Diversity Market Study is to formulate a set of conclusions and recommendations through a review of business requirements related to localisation or internationalisation in the area of Information Society Technologies. The recommendations will suggest to CEN [1] and the European Commission [2] what activities could be undertaken to support standardisation and other types of actions (e.g. guidelines, best practice building and Commission recommendations and directives) in this area.

Our study takes place in the context of a general shift from a local or regional focus towards a global marketplace. This has been a gradual development over the last century, but the introduction of new technology, and especially the Internet, has greatly accelerated the visibility of this process. This development is referred to as *Globalisation*. In the IT domain, two other terms are used: *Internationalisation* and *Localisation*.

Internationalisation (sometimes shortened to *I18N*) is the process whereby products and services are implemented in a way that allows for adaptation to local languages and cultural conventions.

Localisation (or *L10N)* is the process of adapting products and services to a specific local environment, involving use of appropriate character sets, translations and other aspects that make the products and services usable for users in that specific culture.

Globalisation, internationalisation and localisation are closely related to what is called *cultural adaptability*.

ISO/IEC JTC1 N4627 [3] defines *cultural adaptability* as:

> The special characteristics of natural languages and the commonly accepted rules for their use (especially in written form) which are particular to a society or geographic area. Examples are: national characters and associated elements (such as hyphens, dashes, and punctuation marks), correct transformation of characters, dates and measures, sorting and searching rules, coding of national entities (such as country and currency codes), presentation of telephone numbers, and keyboard layouts.

We have broadened the scope to include some less technical aspects, identifying six areas that are potentially relevant:

- Infrastructure aspects (fixed and mobile telecommunications infrastructures and connection policies, network protocol and mark-up language internationalisation);
- Input/output aspects (keyboards, character sets, ordering, sorting, data formats);
- Linguistic aspects (translation, writing style);
- Design and content aspects (look-and-feel, localised content);
- Commercial aspects (branding, marketing, communication, client services, pricing, payment mechanisms);
- Legal aspects (applicable law, consumer protection, privacy, liability, complaints)

From its objectives, the study looks at the issues related to cultural adaptability in the light of “standardisation”. At this point, it is useful to define what type of activities that we include under this term.

Formal standardisation

These are activities carried out by formal bodies, such as the International Organisation for Standardisation (ISO) [4] in co-operation with the International Electrotechnical Commission (IEC) [5]; the European Telecommunications Standards Institute (ETSI) [6]; the European Committee for Standardisation (CEN); and national standardisation bodies (e.g. the various national standardisation organisations in the European countries, NISO in the US [7], and JISC in Japan [8]). These bodies usually have a formal definition of membership and voting procedures, in a way that open access to the development process is ensured. The work usually leads to formal documents that are maintained over time. These documents can have a legal status when endorsed by administrations.

Semi-formal or informal standardisation

These activities are carried out by organisational groupings from industry or professional societies, e.g. the Internet Engineering Task Force (IETF) [9], the World Wide Web consortium (W3C) [10], the Unicode consortium [11], ECMA (formerly the European Computer Manufacturers Association) [12] and the Localisation Industry Standards Association [13]. Membership and procedural models may vary from closed groups with invited membership to open membership (either free or based on payment of membership fees). These activities also lead to publication of documents which are maintained, although with (usually) less formal status. From a practical perspective, they are sometimes more important to industry than formal standards. In certain cases, informal standards can be submitted to a formal standardisation body and act as precursors to the formal standardisation process.

Guidelines for best practice

These activities range from general material on design guidelines, such as books and articles on user interface design, system design and Web design to vendor specific guidelines. Here there is usually no defined membership or procedural model, and results are commonly available in the public domain or at purchase price in an open competitive environment.

Government regulations

Binding rules and regulations issued by governments and supra-national organisations such as the European Commission form a category of a slightly different scope. The types of activities also have the intention to establish a 'level playing field' for actors, and do so by creating legal and regulatory frameworks for industry activities. In some cases, government regulations refer to standards documents (mostly of the formal kind) mandating certain technical solutions.

2. Approach

The study has been conducted along two parallel tracks:

a. A standards survey, based on desk research on standardisation activities in the area of cultural diversity through a number of sources, referred to in the text and fully referenced in chapter 6, and a questionnaire that was sent to standardisation experts

b. A market survey based on responses to a questionnaire that was sent to various types of market players, including content providers, international organisations and projects, localisation companies and consumer organisations.

The preliminary conclusions and recommendations that were drafted from these two tracks have been validated in a panel meeting on 25 January 2001 in Brussels with the following participants:

- Michael Anobile, Localisation Industry Standards Association, Switzerland
- James Boyd, CEN, Belgium
- Erkki Kolehmainen, TIEKE, Finland
- Anne Lehouck, European Commission DG Enterprise, Belgium
- Rose Lockwood, BerlitzGlobalNet, UK
- Gregor Thurmair, Sail Labs, Germany
- Marc de Vries, PricewaterhouseCoopers, Netherlands

And the study team:

- Makx Dekkers, PricewaterhouseCoopers, Luxembourg
- Robbert Fisher, PricewaterhouseCoopers, Netherlands

The draft final report will be presented in an Open Meeting on Standards and Cultural Diversity organised by CEN/ISSS in Brussels on 22 February 2001. The final report will be available for public distribution in March 2001.

Standards survey

The standardisation desk research was based on a number of sources that are referred to in the text in chapter 3 and are fully referenced in chapter 6. A questionnaire was sent to 26 experts who have been involved in various standardisation activities in the area of cultural diversity.

Market survey

The market survey was conducted through personal contacts and a questionnaire that was sent to people with various backgrounds, enabling a number of perspectives to be taken into account.

The table below summarises the backgrounds of addressees and respondents of the two questionnaires.

Cat.	*Category*	*Sent*	*Response*	*Not relevant*	*Pending*
1	Standardisation experts	26	16	1	
2	Content providers (publishers, information services, international organisations)	42	8	2	19
3	Software and hardware industry	19	8	3	
4	Localisation industry	26	7	1	4
5	Technical and strategic research	16	7		2
6	User and consumer organisations	3	1		2
7	International programmes and frameworks	3	2	1	
		135	**49**	**8**	**27**

In total, 49 responses were received on the 135 questionnaire distributed, a response percentage of 36%. Participation from content providers, the localisation industry and consumer organisations was less than average. In addition to the 49 responses, 8 respondents have communicated that the issue was not relevant to them and therefore they did not give any answers. Furthermore, another 27 organisations did agree in personal contact to answer the questionnaire but did not do so in time for their response to be included in this report. In the table above, these are indicated in the column “pending”.

In the course of the survey, direct contacts (either through telephone or face-to-face meetings) have taken place with 73 organisations. Some of the conclusions in this report, specifically the ones relating to perception and awareness issues, have been drawn based on these direct personal contacts.

In chapter 3, the results of the research and survey have been summarised under seven headings:

- General aspects
- Infrastructure aspects
- Input/output aspects
- Linguistic aspects
- Content and design aspects
- Commercial aspects
- Legal aspects

Under each of these headings, an overview is given of the activities that have taken place in standardisation, guidelines and regulation. The opinions of respondents are summarised under the questions in the questionnaire.

3. Results

General aspects

A list [14] of a wide variety of materials is maintained by the ACM [15] working group on intercultural issues SIGCHI [16]. This list has been a major resource for the desk research.

On a general level, cultural diversity issues in system design have been addressed in the last couple of years at two major meetings (the Web Internationalisation & Multilingualism Symposium, Seville, 1996 [17] and the ISO Cultural Adaptability Workshop in Ottawa, 1998 [18]) as well as in a number of conference series (IWIPS [19] and ACM CHI [20] conferences).

All aspects mentioned in chapter two are being addressed in these events. Analysing the reports of the various events, a summary list of issues can be drawn up as follows:

- Protocol and mark-up language internationalisation
- Character set issues, including ordering, sorting, indexing and searching
- Concepts and tools for multilingual system design and implementation
- Cultural conventions related to measurement units and value formatting (date/time, currency, decimal point vs. comma)
- Some non-technical issues, e.g. colours, fonts, icons, and price advertising including or excluding applicable taxes)

Where the earlier events concentrated on questions as to what cultural adaptability encompasses and how it related to standards bodies, technical developments and government involvement, in the last few years attention has shifted to the question how to successfully implement internationalisation and localisation in systems and services, and how to overcome barriers, for example in user interface design and in upgrading of legacy systems and data collections.

In the area of consumer requirements, two major reports have been published:

- The ANEC report on “Consumer Requirements in relation to ICT Standardisation” in 1998 [21] which recommended that multicultural and multi-linguistic aspects be considered when developing global ICT standards and that cultural backgrounds be taken into account in evaluation of ICT;
- The report “Consumer requirements in standards in Information and Communication Technologies”, study by a project team set up by the ICT Standards Board and administered under the auspices of CEN/ISSS in 1999 [22] which concluded that standards must apply globally if proper use is to be made of the facilities created by the Information Society, but that regional, social and cultural differences must also be taken into account.

Survey results

As part of the survey, we have received general comments on the issues raised in the study that are not for one of the six specific aspects covered. These comments are summarised below. Also, in the direct personal contacts that we had, a number of observations were based on how we were guided through the organisation before we connected with the contact person. In general, we identified a first point of contact through lists of speakers and participants of relevant events or from articles on the subject. In other cases, we contacted the central e-mail or telephone number for general inquiries. From the first contact, in many cases we were referred to the person who was considered to be the most appropriate for participation in this survey.

We observed apparent differences in the perception of cultural diversity in Europe and the US. In European companies and organisations, the contact point for these issues is almost invariably a technical department and a higher-level view of the issues seems to be lacking. In US companies, the contacts are usually with the marketing or international business development departments.

US companies seem to have much more of a global view and have begun thinking about optimising internal business processes to deliver products and services in multiple cultural environments, whereas in Europe localisation appears to be much more an afterthought. This was already identified by the eContent localisation study [24].

Furthermore, particularly in Europe, localisation is seen primarily as a cost factor and much less as a means of delivering potential benefits. There seems to be a lack of specific data on the cost/benefit equation related to localisation activities.

It needs to be noted that many participants in the survey question the role that standardisation and consensus building can have to support cultural diversity. In many reactions, an underlying perception can be noted that standardisation is based in bureaucratic principles. A fear is being expressed that standardisation hinders rather than facilitates the emergence of appropriate solutions by limiting the possibilities to find innovative solutions. However, it is felt that informal consensus building can help to find compatible solutions to common problems. In this context, the new approach that CEN has taken in the ISSS activities to concentrate more on consensus building than on formal standardisation is insufficiently known.

Both from the hardware and software industry and from consumer organisations we have received suggestions that mandated internationalisation criteria in public procurement could help to promote the importance of cultural diversity.

Especially standardisation experts are aware that standardisation processes, because of the formal consensus procedures involved, are time-consuming. Especially in the area of Information Society Technologies, technology moves fast. As a result, technology can overtake standardisation, creating a gap between official standards on one hand and industry-standards and products on the market on the other hand. A more informal approach with more industry involvement would work better because up-to-date knowledge of emerging technologies would be directly involved in the process.

In looking at the various models of standardisation and consensus building (formal versus industry-led), there are issues related to the openness of the different approaches. In official, ISO-type standardisation, on the one hand, the mechanisms to ensure

involvement of national interest through participation of national standards bodies creates a globally level playing field; on the other hand, the participation of market players is limited to invited experts at the discretion of specific standardisation groups. In industry-led activities, participation is often open to any organisation willing to pay membership fees (such as is the case in W3C) but equal representation of national interests is not secured.

In various reactions the issue of geographic coverage of activities is addressed: as the issue of cultural diversity is fundamentally global, there needs to be good co-operation on a global scale. However, the relatively coherent environment in Europe would allow activities to be initiated on the European level, at the same time maintaining a strong link with global groups and activities, most notably in ISO, IETF and W3C. After all, Europe with its various cultural backgrounds can act as an example environment to address multicultural issues.

Promoting awareness of the importance of cultural diversity issues and wide availability of information on the standards and guidance activities is very important. The European Commission could play a role by reinforcing these issues in the eContent initiative and possibly through a specific awareness campaign.

Infrastructure aspects

Connection policies and pricing

If we look at the connection policies, there are different approaches that can be observed across Europe. In contrast to the situation in the United States, where local access is usually on a flat fee basis, in most places in Europe calls are usually charged on time basis. This is an aspect that needs to be taken into consideration by companies who want to deliver networked services.

The European Commission has published a Communication on Unbundled Access to the Local Loop [25] with the objective to increase the competition in the local access networks, thereby *accelerating Europe's transition to the new information society, in particular through the deployment of cheap internet service.*

The introduction of fixed-fee connections by certain Internet providers and ASDL holds the promise for a more consumer-friendly usage of the Internet in the near future.

Protocol and mark-up language internationalisation

The major activity in this area is the I18N/L10N activity of the World-Wide Web Consortium [26]. Recommendations have been published on the use of non-ASCII characters in Universal Resource Identifiers and other identifiers, on character set and language negotiation in HTTP and on language tags in HTML, CCS2, XML, RDF, SMIL, DOM, Xpath and XSLT.

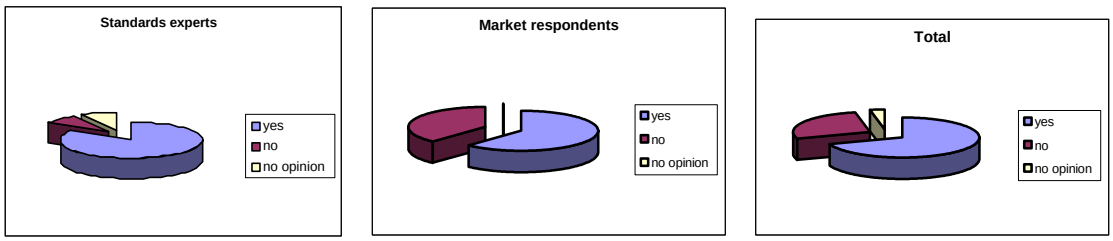
One specific issue is being addressed by the OSCAR activity within LISA, to include tags in XML to enable the automatic operation of translation tools on XML documents [27].

Survey results

The first survey question under this aspect was:

1.a. Is there a need for specific standardisation effort in this area, other than work being done on telecommunications standards and current work in W3C's Internationalisation activities?

The results are based on 12 responses from standardisation experts, 21 from market respondents, to a total of 33 responses.



Further improvement of reliable and affordable access to the Internet is considered to be important. Harmonisation of access policies and regulation of ISP offerings could help

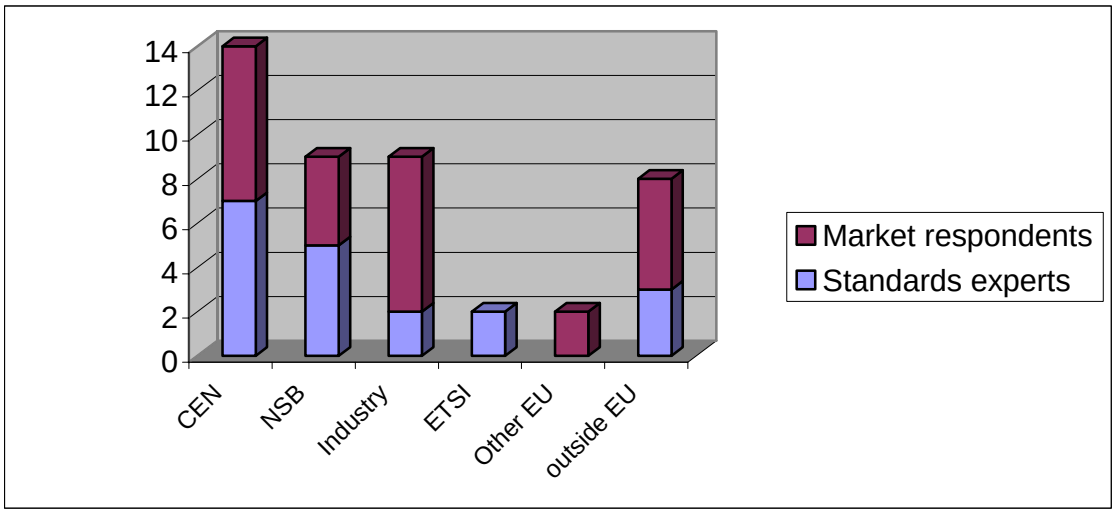
this, both from a social perspective (ensuring fair access rights to citizens) as well as from a business perspective (providing a common platform for Internet business).

Additional work in the technical area that is identified are technical solutions for support of cultural diversity in protocols and mark-up languages for mobile applications and for handling of multi-modal content, the inclusion of support for localisation tools in mark-up languages in standardised ways, to declare metadata that triggers locale-related parameters, and to standardise interfaces with assistive technologies. It is suggested that better documentation of standards and agreements should be available, possibly in multiple languages.

The second question was:

1.b. Who could take this role in Europe?

The result:



On the technical level, the leading role of W3C is recognised by all participants in the survey, although it is identified that W3C could do more and faster. Many respondents see a role for CEN to leverage European resources, in co-operation with national standards bodies (NSB). Especially from the market respondents, the involvement from industry and industry groupings like LISA in these activities is strongly emphasised.

It is however stressed by many respondents that the issues are fundamentally global and that therefore any activity in Europe must work together with initiatives on a global level, most notably W3C, IETF and ISO. This stems from a fear that the scarce human resources are dispersed among various groups doing the same work. Some participants have the opinion that European organisations should be directly involved in the global initiatives rather than work in a European platform, but many see a role for European platforms to provide collective European input into the global arena.

A balance is considered necessary between formal standardisation (which gives stability and the explicit inclusion of national components) and industry-led activities (which can bring in the market players). It is extremely importance that all relevant players (industry, administrations, consumers) are involved, to also take into account social objectives.

Input/output aspects

Groups

In the area of input and output functions related to human-computer interfaces, the major groups are ISO/IEC JTC1/SC2/WG2 [28] (responsible for ISO/IEC 10646), ISO/IEC JTC1/SC22/WG20 [29] (responsible for ISO TR11017 – Framework for Internationalization [30] and ISO 15897 – Procedures for registration for cultural conventions [31]), the Unicode consortium and CEN TC304 [32]. Also, major software vendors do work in this area (e.g. Microsoft and Netscape) establishing guidelines for programmers.

Locales

An important concept is the notion of so-called 'locales' that provide a way to identify various settings related to cultural environments. Ideally, this would take the form of a single parameter to be set by the user of a hardware device (e.g. personal computer) after which the system including all software makes a global change to configure the user interface and the background processes to meet the user's expectation. This would affect the language, character set, sorting order of items in a list, date and time formats, decimal comma or point, and various measurement units.

However, the there is no strict definition for locales. For example, ISO 14652 [33] defines an FDCC set (Formal Definitions of Cultural Conventions) as a superset of the 'locale' term in C and POSIX, containing parameters related to character set handling as well as conventions for the format of numbers, date and time, currency, personal name, telephone numbers, and size of printing paper. In UNIX a locale is defined as the language environment determined by the application at run time, including specification of language, territory, and code set. In general, locales are related to programming languages and Application Programme Interfaces, and do not directly address the user interface.

Character sets

A major achievement in the area of character sets is the standardisation of ISO/IEC 10646, the Universal Multi-octet Coded Character Set standard (UCS) [34]. This standard is compatible and harmonised with the Unicode character set [35] developed by the Unicode consortium.

UCS is generally considered to provide the ultimate solution for character set coding, and most vendors have adopted this approach for their products or have published their intentions to support it. UCS theoretically enables the definition of all known character sets and writing systems, and is still being extended. There is however the fact that a substantial amount of software is not yet based on this standard but on earlier international standards, such as ISO 8859 [35].

CEN TC304 has developed three Multilingual European Subsets for the use of UCS (MES-1, MES-2 and MES-3) [37] to facilitate the implementation of only those parts of UCS that are relevant for European regions.

- MES-1 provides for the minimal needs of some national governmental administrations in Europe and contains basic Latin script, extensions to Latin script and a number of symbols;
- MES-2 extends this with Greek and Cyrillic scripts and additional technical symbols and provides a greater step towards the implementation of large character sets in Europe;
- MES-3 provides a second step by covering all characters belonging to European scripts, adding Armenian, Georgian, combining diacritical marks and more special symbols.

These three subsets have been registered into ISO/IEC 10646, but in practice, these recommendations have not been widely adopted.

Matching, indexing, ordering and sorting

Matching and indexing of UCS text is addressed in W3C in the draft on "Requirements for String Identity Matching and String Indexing" [38]. This document addresses the issues of string matching and string indexing with the objective to bridge the gap between user expectations and internal operation of the W3C character model to ensure consistent behaviour on the WWW.

Ordering and sorting is addressed by ISO/IEC JTC1/SC20/WG22 in ISO/IEC 14651 [39] that provides a method, applicable around the world, for ordering text data, and provides a Common Template Table which, when tailored, can meet a given language's ordering requirements while retaining reasonable ordering for other scripts. The Common Template Table describes an order for all characters encoded in the first edition of ISO/IEC 10646-1 up to Amendment 7.

CEN TC304 has developed the European pre-standard ENV 13710 [40], dealing with multilingual ordering rules for Europe as a profile of ISO/IEC 14651. It is technically equivalent with the Unicode Collation Algorithm.

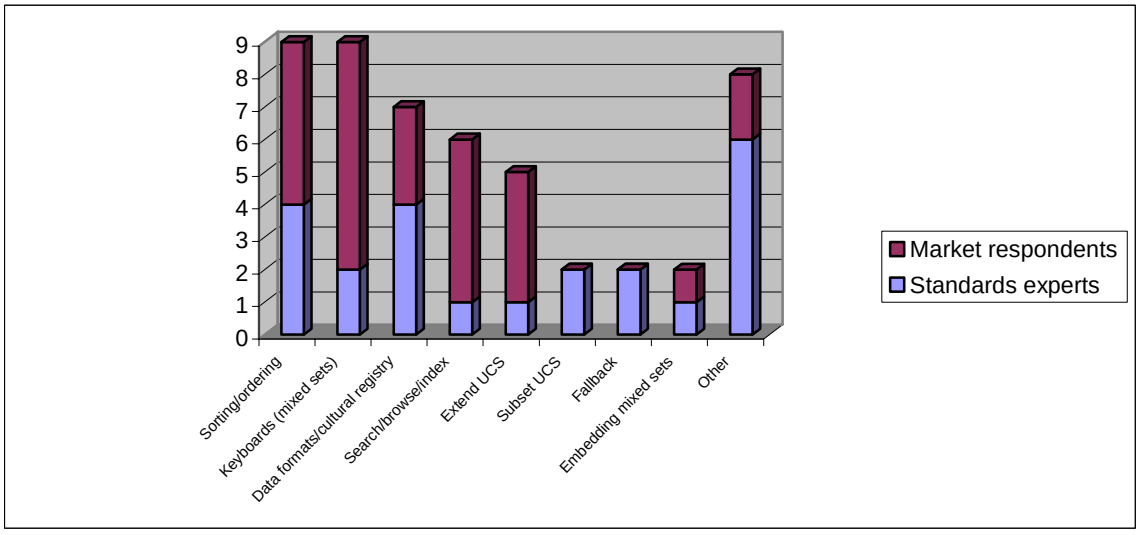
The Unicode consortium has developed the Unicode Collation Algorithm [41] providing a specification of how to compare two Unicode strings.

Survey results

The first question under this section was:

2.a. In the standardisation domain, what are the most pressing needs for further work?

The results are represented in the following diagram:



All respondents agree that the basic character set issues have been solved with UCS, at least in principle and especially for the major European languages. Additional work is identified as useful in extending UCS with characters for minority languages.

Even if UCS would be implemented in back-end and database systems, there is still the problem of indexing and searching of databases with UCS content and ordering of retrieval results. Not many respondents are aware of the activities that are taking place in W3C, ISO, CEN and the Unicode consortium in this field. From the responses, it seems like activities on awareness raising and best practice in this area would be helpful.

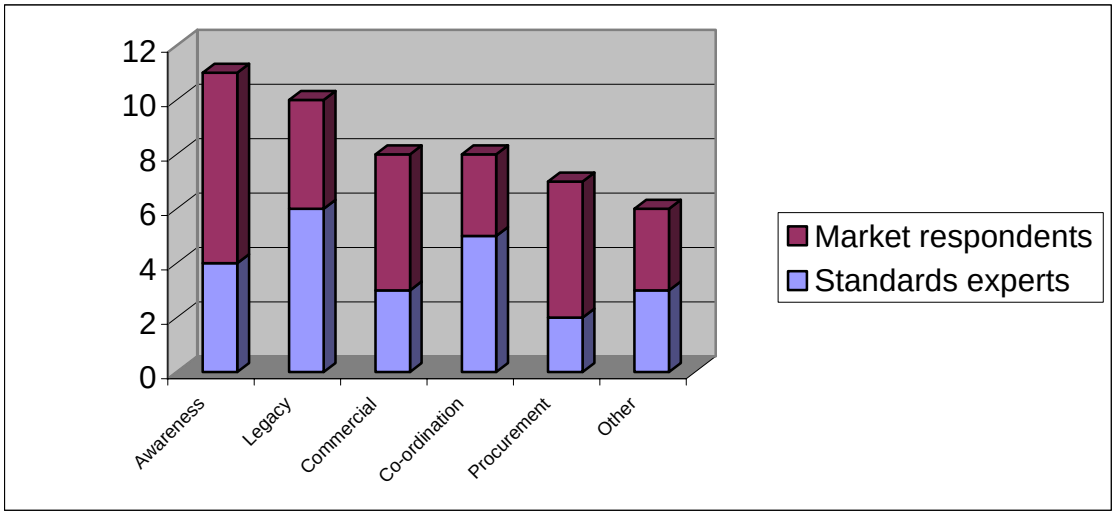
Additional work is considered necessary related to input of UCS characters. There are many national standards for keyboards that do not easily allow input of extended character sets. It is not realistic to assume that a standard multilingual keyboard will replace these national keyboards. Several participants suggest solutions where these national keyboards are enhanced by downloading additional characters and soft keyboard layouts into an adaptive user environment in those cases where multiple scripts are involved such as combinations of Latin-based scripts with Greek, Cyrillic or Asian languages.

Not related to character sets, it is considered necessary to register the various data formats (date, time, weights and measures) in a cultural registry.

The second question was:

2.b What are the barriers that impede the industry take-up of the results of standardisation in this area, such as UCS and MES, and what could be done to encourage industry take-up?

The results:



Because of difficulties of integrating UCS in existing products, the take-up of UCS is perceived to be slow. An opinion that is expressed, especially from market respondents, is that there is insufficient awareness in the market of the practical implementation issues and the commercial implications (both in cost and benefit) of UCS implementation.

An important impediment is also the substantial cost of re-engineering applications and products. In the marketplace, these costs are obviously seen in relation with the size of particular markets, which means that the requirements of the larger and richer countries are being met first. It is suggested that more publicity of the benefits to international business and publication of positive results would help to stimulate widespread take-up of UCS in products and services.

There is an interesting difference in opinion between content providers who feel that the hardware and software industries have a lack of interest in the provision of full UCS support, whereas the hardware and software developers point to a lack of knowledge whether implementing UCS will indeed solve the content problems. Developers ask for availability of best practice examples, and in some cases, for inclusion of UCS support in public procurement.

There are specific remarks on the usefulness of the Multilingual European Subsets of UCS as developed by TC304, where some respondents point out that the electronic marketplace is not limited to Europe and that it is not clear what the relevance of European subsets is from a global perspective. One respondent characterises MES as a solution in search for a problem.

There is a need for further co-ordination between groups working in this area, specifically involving market parties in the work. Here again, there seems to be insufficient knowledge on the co-ordination that already takes place, e.g. between ISO, CEN and the Unicode consortium.

A number of respondents indicate that inclusion of requirements for UCS support in public procurement could help a further acceleration of implementation in IT products.

Linguistic aspects

Language identification

For the identification of languages, a number of standards are available: ISO 639-1 (two letter codes for 136 languages), ISO 639-2 (three letter codes for 460 languages) [42] and IETF RFC 1766 [43] (identifying languages and variants through a combination of language tags from ISO 639-1 and country codes from ISO 3166-1 [44]). These approaches to language identification cover only a subset of all languages in the world.

Another major source for language codes, the Ethnologue [45], identifies over 6.000 languages, and has assigned codes for all of these. Constable and Simons [46] have argued that the ISO and IETF approaches are not based on a consistent model and propose the use of an extended model using the three letter codes used by the Ethnologue when no codes are available in ISO 639 or IETF RFC 1766. They warn however for using the language code to control not strictly language-related behaviour such as spelling and sorting.

A number of research projects under the Language Engineering and Human Language Technologies programmes [47] of the European Commission address the more fundamental issues of standardisation related to language and translations by identifying areas where some form of standardisation or harmonisation could be beneficial.

The Expert Advisory Group on Language Engineering Standards (EAGLES) [48] was an initiative of the European Commission, within DG XIII Linguistic Research and Engineering programme, which aimed to accelerate the provision of standards for very large-scale language resources (such as text corpora, computational lexicons and speech corpora) and means of manipulating such knowledge, via computational linguistic formalisms, mark up languages and various software tools and means of assessing and evaluating resources, tools and products.

ISLE (International Standard for Language Engineering) [49], a follow-on to EAGLES, aims to develop language technology standards within an international framework, in the context of the EU-US International Research Cooperation initiative. Its objectives are to support national projects, research projects and the language technology industry in general by developing, disseminating and promoting de facto standards and guidelines for language resources, tools and products. ISLE will initially focus on three areas of standardisation: multilingual lexicons, natural interaction and multimodality (NIMM) and evaluation of language technology systems.

SALT (Standards-based Access to multilingual Lexicons & Terminologies) [50] combines two recently finalised interchange formats: OLIF (Open Lexicon Interchange Format) [51], which focuses on the interchange of data among lexical databases from various machine translation systems, and MARTIF (ISO 12200:1999, MAchine-Readable Terminology Interchange Format) [52], which facilitates the interchange between terminology databases.

Multilingual dictionaries have been in use for some time, mostly in specific areas. Examples are:

- Eurodicautom, the multilingual terminological database of the European Commission's Translation Service [55]

- Eurovoc of the Office for Official Publications of the European Commission, intended to be used by libraries, documentation services, documentary databases of the EU institutions, as well as by the users of these services [56]
- Agrovoc, a multilingual thesaurus for indexing and retrieving data in agricultural information systems, managed by FAO. [57]
- Population Multilingual Thesaurus by Cicred [58]
- GEMET, the General Multilingual Environmental Thesaurus of the European Topic Centre on Catalogue of Data Sources of the European Environmental Agency [59]
- Multilingual Egyptological Thesaurus of the Computer Working Group, International Association of Egyptologists (IAE)/ Comité International pour l'Égyptologie (CIPEG), International Council of Museums (ICOM) [60]

Some more examples [61] can be found on the website of ELRA, the European Language Resources Association [62].

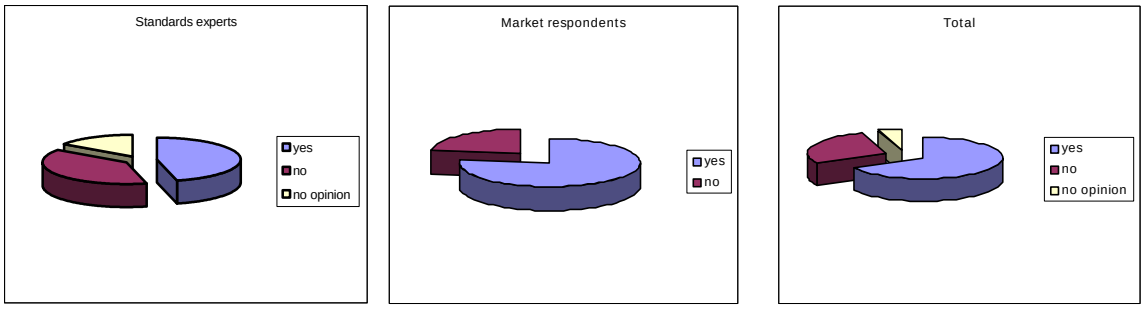
In contrast to these activities that propose solutions based on list of terms in various languages, the Basic Semantics Register (BSR) [63] was set up in 1998 by ISO Technical Committee 154 (TC 154) to act as a central reference to assist in the universal, multilingual understanding of data across commerce, industry and administration. The BSR has been defined as an official ISO register of non-ambiguously defined semantic data. BSR data are identified by numbers, so it is not dependent on any particular language, and is intended to describe concepts independently of any particular context. BSR can therefore act as a tool for establishing bridges between different data dictionaries.

Survey results

The first question under this aspect was:

3.a. Is there a need to standardise multilingual vocabularies that could be used as a basis for machine translation of text?

The results in graphical form, based on 13 responses from standards experts and 26 from market respondents, to a total of 39 responses.



It is a general perception that machine translation has not delivered the results that were expected in the last 20 years and can only contribute in a very limited way to help building multi-lingual products and services. It is, however, felt that multilingual vocabularies of terms can be helpful in specific domains, especially for concept

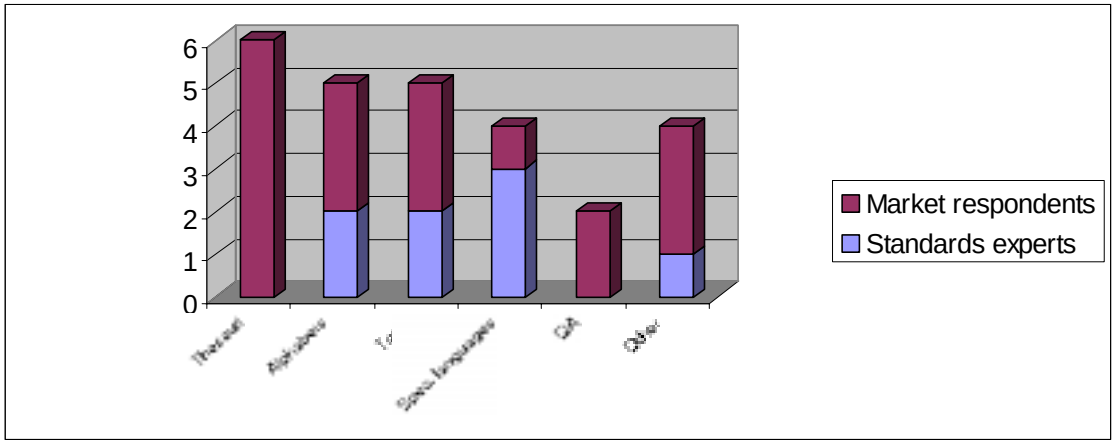
vocabularies and ontologies. These multi-lingual vocabularies would be most useful if they were machine-readable and available on the Web, and need to be linked together through a concept registry.

It is felt that rather than prescriptive standardisation of terminology, formats and exchange mechanisms could be standardised. There are replies indicating that more co-ordination is needed between the people who create terminologies and those who want to re-use it (in machine translation and applications). Standardised multilingual vocabularies could play an important role for the exchange of metadata, especially in the public sector. In the commercial sector, however, vocabularies supporting Translation Memories are often considered commercial value.

The second question was:

3.b. Are there any other language issues that could benefit from standardisation efforts?

The results:



Several market respondents indicate the need for multilingual thesauri and language-independent ontologies, which could be published through Web-based registries. The development of these thesauri is considered the responsibility of domain-specific initiatives and groups and not of formal standardisation groups.

A number of respondents indicate that work is needed on issues related to alphabets, although others explicitly point to problems that have been encountered by the CEN/ISSS Alpha workshop.

Like under the input/output aspects, several respondents point to the necessity to look at issues related to specific smaller languages and dialects as the current work on language technologies concentrate for the major part on the more important languages in Europe.

A specific item that is mentioned by the standardisation experts is the necessity to improve the ability to tag data with labels indicating the content language with better precision and wider reach than is possible with RFC1766 and the ISO standards it references, as was also argued by Constable and Simons.

Several participants point out that there is a need for general quality guidelines and standards for translations and localisation. It is suggested that an ISO 9000-type

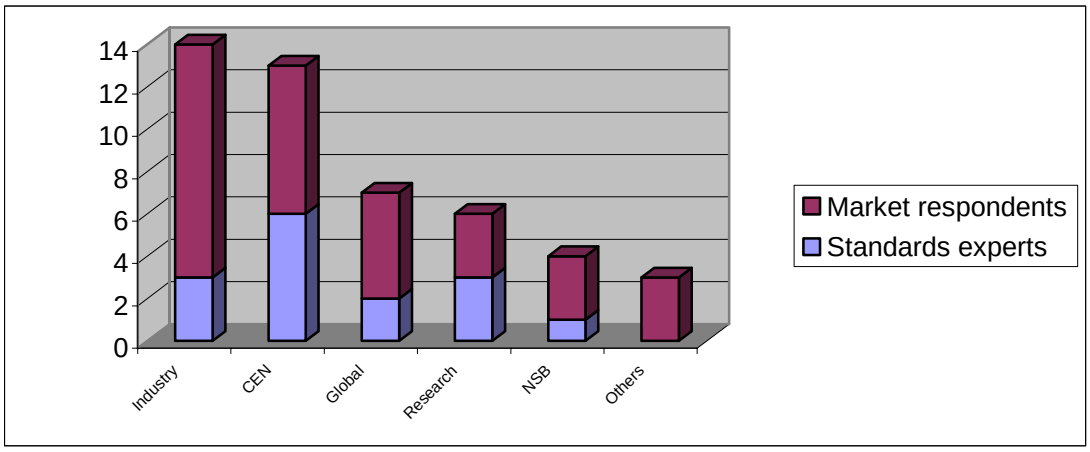
certification could help customers of localisation to gain confidence in the result of translations. Codes of conduct could help in making Web sites more understandable to a wide variety of users, and help to make the pages easier to translate.

In the area of speech recognition, much work has taken place in Europe under the ESPRIT programme, which has led to a number of largely compatible solutions, which might benefit from formal recognition through a CEN Workshop.

The third question:

3.c. Who could take this role in Europe?

With the result:



The general opinion of the participants in the survey is that the work in addressing consensus building need to be led by industry, with CEN and global initiatives (W3C and ISO) standardising the results if necessary. Researchers need to play an important role in the linguistic area, as this is a highly specialised domain where fundamental problems still need resolving. The Human Language Technologies research programme with the new eContent initiative from the European Commission promises to provide useful results in this area.

It is suggested that collaboration between industry, formal standards bodies and research would ensure that appropriate solutions are found and stabilised. ELSNET, the European Network of Excellence in Human Language Technologies, is mentioned as a potential platform for co-operation as its main objective is to advance human language technologies in a broad sense by bringing together Europe's key players in research, development, integration or deployment in the field of language and speech technology and neighbouring areas.

Content and design aspects

Work on the general area of ergonomics in IT-based products and services has taken place in ISO TC159/SC4 Ergonomics for Human System Interaction, which developed ISO standard 9241 [65] which contains general principles of dialogue design for computer displays in parts 10 and 12 and specific dialogue design techniques in parts 14, 15, 16, and 17. The chairman of TC159/SC4, Stewart, has published a report on the usefulness of ergonomics user interface standards [66]. One of his conclusions is that it is difficult to reach consensus on design issues because there are many conflicting viewpoints and commercial interests. As a result of this and other problems that he describes, the work on ISO 9241 has taken more than 17 years to complete.

Outside of the formal standards domain, this is the realm of authors of design handbooks on interface design (e.g. Jakob Nielsen [67] [68], Steven Pemberton [69], Walter Maner [70]), system design (e.g. Jennifer Decamp [71]), Web design (e.g. Michael Lerner [72]), and vendor specific guidelines (e.g. Microsoft [73], Netscape/Mozilla [74] and SUN [75]).

Furthermore, there are many international consultancy firms that provide services to companies in the area of product design and localisation of product and services.

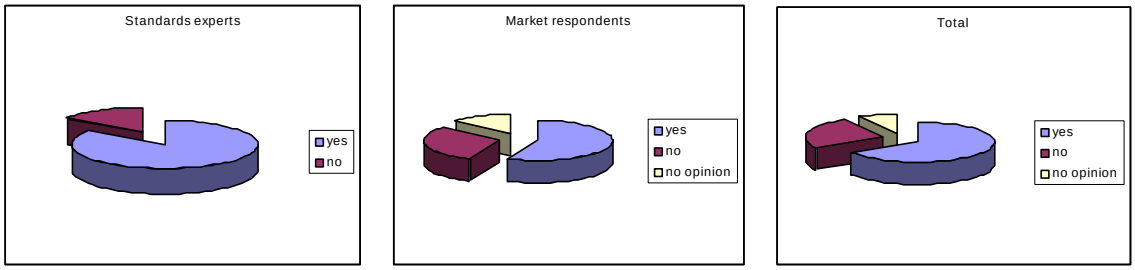
Otherwise, there are specific activities in the accommodation of requirement of the disabled (e.g. in the W3C's Web Accessibility Initiative WAI [76] and the ICT Standards Board report "Design for All and Assistive Technologies" [77]). An interesting regional initiative in this area is the set of guidelines for Web design that was published by the Canadian government to be respected by all Canadian government agency Web sites [78], [79].

Survey results

The first question under this aspect was:

4.a. Is there a need for guidance and best-practice information to help developers to better serve a multicultural audience?

The result in graphical presentation:



Especially in the area of content and design, many survey participants feel that there is a tension between standardisation and healthy market developments, where formal standards would hinder industry to develop best approaches. If anything would be useful, it would be in the form of best practice guidelines that can be used on a voluntary basis.

It is pointed out that localisation is much broader than translation and that content localisation involves in many cases, e.g. retail on the Web, a completely different product offering. Also, the presentation of content is very much related to corporate identity.

Many think that this is best left to the individual companies. The market will judge the solutions and the products that implement the best solutions will become the most successful. However, taking a more political standpoint, consumers would benefit from quality guidelines that make products easier to understand.

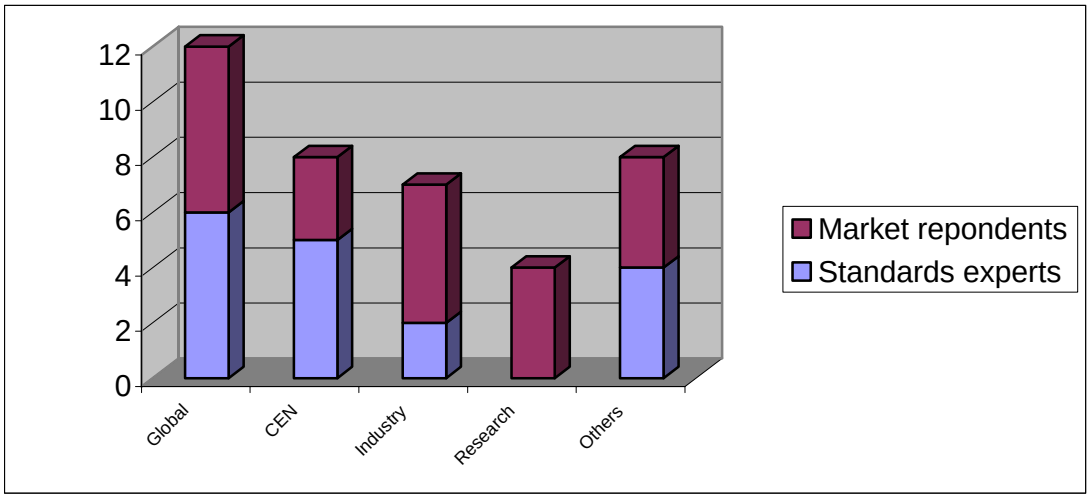
Indeed, several respondents think that it would be helpful if broad guidelines could be available for usability of interfaces, either supporting the design and development process or defining criteria for evaluation of user interfaces. One of the effects of such guidelines is that there would be a growing awareness of the complexity of addressing multi-cultural audiences. Examples of subjects in guidelines are descriptions and anecdotes for culture-specific allusions to text and graphics, values, taboos, humour and symbolism.

Specific areas that are mentioned where guidelines could be helpful are the development of effective retrieval interfaces and application of speech browsing in mobile communications.

The second question was:

4.b. Which groups or organisations would be best placed to develop such material?

The results:



Here there is a perception that this type of work would need to have a global perspective. Various global platforms are being mentioned for the development of guidelines: W3C, IETF, the Unicode consortium and ISO, but only for certain aspects that are considered useful in the market. The role of CEN would primarily be to provide a meeting forum for industry. Specifically, the market respondents see the leading role in global industry platforms like LISA. Market respondents also indicate that researchers could have a role addressing issues in the fields of cognitive psychology, socio-anthropology, ergonomics, and accessibility/disability studies. Some work is suggested under the eContent initiative to produce briefings and tutorials for people who are newcomers in the field of multi-cultural products and services.

Commercial aspects

Activities related to commercial aspects in multicultural environments do not in general take place in a standardisation or consensus building environment. There are however activities in the broader context of electronic commerce standardisation that need to look at cultural diversity issues.

The CEN Workshop on Electronic Commerce [79] works on standards for Business-to-Business applications. The work plan for the year 2001 of this group includes work on:

- eWallet portability and interoperability
- m-commerce application requirements (input to the ETSI m-commerce PT)
- Practical guidance for implementing electronic signatures
- Generic requirements for e-commerce best practices and codes of conduct
- B2C requirements, especially from the perspective of SMEs and consumers
- Overview of sectorial e-commerce activities

The work on eWallet, m-commerce, and B2C requirements are expected to address issues related to internationalisation and localisation.

The issue of payments is related to cultural diversity only sideways, insofar that standard solutions for electronic payments would contribute to a more uniform environment for cross-border electronic commerce and may contribute to increased consumer confidence. Some standards-related activities for micro-payments are being co-ordinated though W3C's Micro Payment activity [81]. A number of companies offer their own solutions, such as IBM's Micro Payment [82], Cybercash [83] and Digicash [84]. Many of these solutions are vendor-specific. In the meantime, most Web sites still use credit card payments, although the use of credit cards on the European continent is not as widespread as in the U.S.

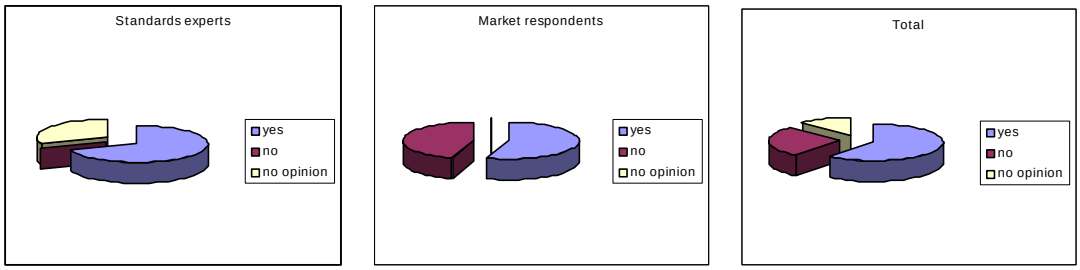
Other issues, such as localisation of helpdesk support, are being covered in the open market by specialised service providers.

Survey results

The first survey question under this aspect was:

5.a. Do commercial players have a need for standards or guidance in this area?

And the result in graphical form based on 13 responses from standards experts and 20 from market respondents, to a total of 33 responses.



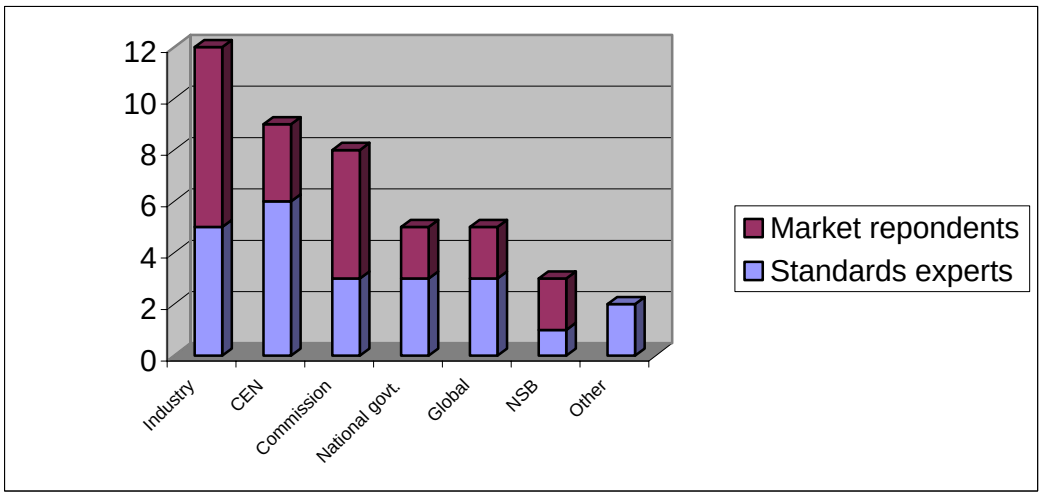
The survey participants are generally in agreement that commercial aspects do not lend themselves to standardisation and consensus building activities. It is expected that market players will build their own through solutions through their own research. This is also an important market for international consulting firms.

Many respondents however suggest that the availability of guidelines or best-practice examples could be helpful to create awareness of different trade environments. Information on pricing models, payment practices and approaches to localising helpdesk support are being mentioned as candidates for work.

The second question was:

5.b. Who could take responsibility for doing this in Europe?

The results:



A wide variety of issues can be grouped under this heading. Some respondents look primarily at business practices and legal requirements, other have a more technical perspective and look at enabling technologies. In the area of documenting business practices, industry would need to take the lead if anything can be usefully done, with involvement from the European Commission and national governments to inform industry about the trade environment in Europe. In the area of enabling technologies, a role for CEN would be in providing a platform for industry to set best-practice in implementation, such as being done in the CEN/ISSS electronic commerce workshop, with strong links to global standardisation bodies (W3C, IETF, ISO) for example for payment and encryption standards.

Legal aspects

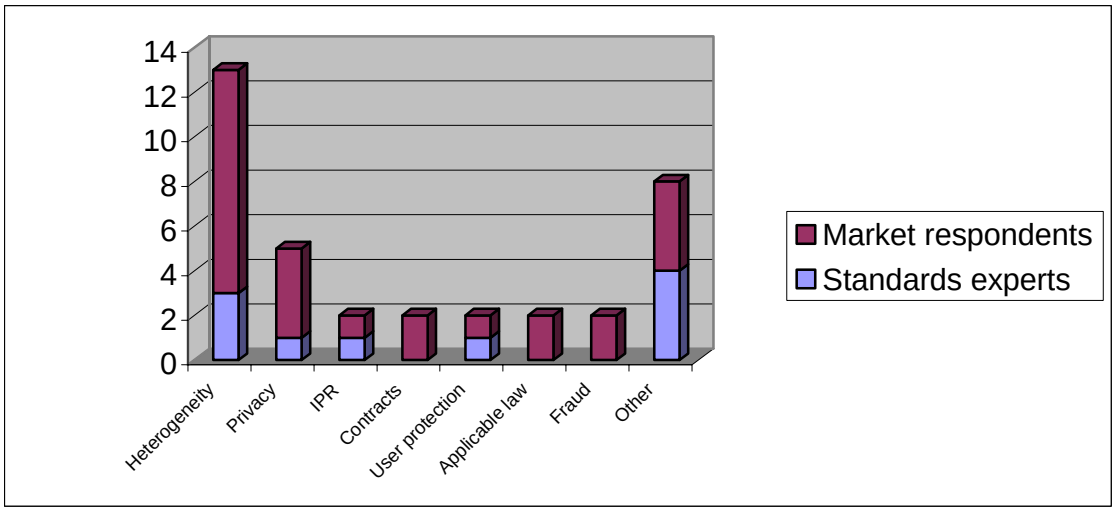
Activities to harmonise the legal environment for electronic commerce have been taken up by the European Commission in the Directive on electronic commerce [85], the Directive on electronic signatures [86] and Communications and Directives on consumer protection and privacy. These initiatives all have relevance for cultural diversity issues, especially in the Internet environment and cross-border e-commerce. The implementation of these regulations in national law in the member states of the European Union follows different timescales. At the same time, national implementations introduce slight variations of the regulations, as Directives leave some flexibility for national implementation.

Survey results

The first question under this aspect was:

6.a. What are the major problems that you see in the legal environment across Europe when developing cross-border services?

The result:



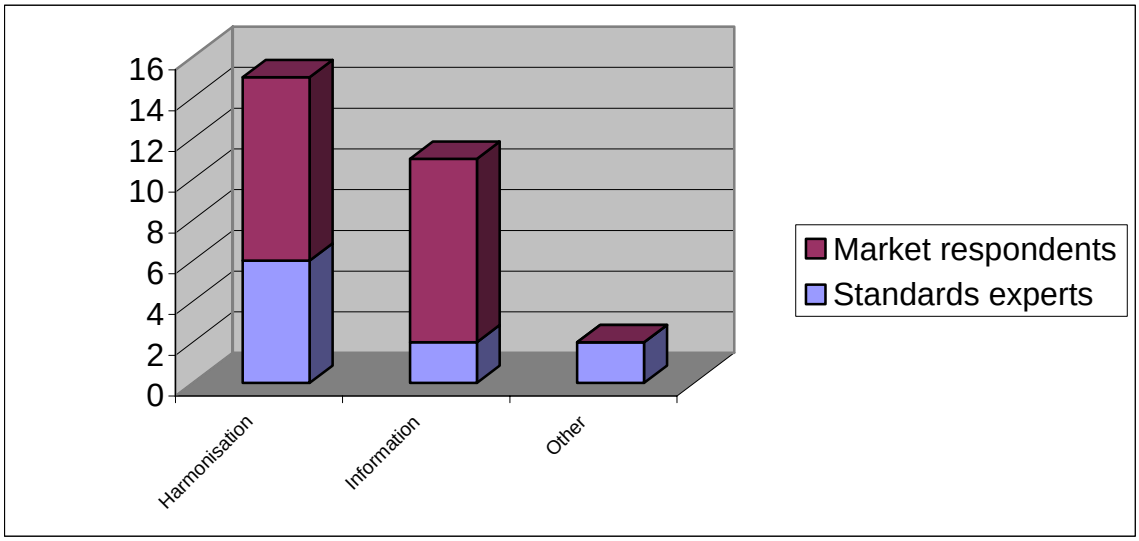
Almost all respondents identify serious problems in this area. The European legal landscape is perceived as difficult to grasp. The heterogeneity of Europe is the issue that is mentioned often, with also perceived difficulties how directives on the European level relate to national laws.

Specific problem areas that are mentioned are privacy, intellectual property and copyright, contract integrity and applicable law, consumer protection, and measures against fraud.

The second question was:

6.b. How could European Institutions help to solve these problems?

The answer:



The respondents are in agreement that the legal aspects are outside of the remit of standards and consensus-building activities and would need to be taken care of by the European Commission and national governments. It is suggested that there needs to be a very strong co-operation between the European Commission and national governments, maybe even with the establishment of an inter-governmental body that monitors problems and proposes solution on a European level. Harmonisation of the legal framework within Europe, but also on a global scale, is a suggestion that comes back many times. The activities of the European Commission to establish a common framework through various directives is considered to be useful, but it is also identified that this does not lead to a truly harmonised environment.

Even if one respondents indicates that a globally harmonised legal framework would be the solution, most realise that this is not easily achieved and not a practical objective in the short and medium term. Suggestions are made that at least the diversity in the legal area needs to be made visible to industry.

Many respondents see value in activities to thoroughly investigate the situation. The results of such investigations should be made available to industry in a way that can be used as a reference source in planning to conduct business in Europe. The establishment of central information service with information on the legal environment in the EU and the member states, and pointers to authoritative information, is considered to be extremely useful.

4. Conclusions

On the highest level, three main conclusions emerge from this study:

1. **There is a lack of awareness of the importance of cultural diversity and of the potential of consensus building activities to solve problems in this area.** Cultural diversity is not an issue that is high on the agenda of European industry and consumer organisations. Many companies and organisations are involved in localisation activities but the issues are often handled in an ad-hoc and relatively unstructured way. It is not clear to industry how standardisation can help in solving problems they do identify in localising products and services, although a number of issues are identified where consensus building could help in finding solutions.

2. **Cultural diversity is addressed mainly from a technical perspective with no quantitative picture of costs and benefits.** In European industry, the contact for localisation issues is usually located in the technical departments where in US companies the marketing or international business development department is the main point of contact. Although it is recognised that localisation is beneficial to users and customers, there is no clear picture of the commercial benefits of localisation based on quantitative data.

3. **There is a need for co-operation in an international environment and with industry.** As cultural diversity is fundamentally global, a European perspective in standardisation and best-practice building needs to take into account the wider picture and activities should be undertaken in co-operation with international fora such as W3C and ISO. Co-operation with industry platforms such as the Localization Industry Standards Association (LISA) will ensure industry input, at the same time establishing channels for dissemination and take-up of the results.

5. Recommendations

Based on the conclusions of the study, the following recommendations are formulated:

The European Commission should:

1. In the framework of the eEurope and eContent initiatives, conduct a publicity campaign to raise the awareness of localisation issues in European industry and consumer organisations, supported through studies into costs and benefits of localisation in Europe and through information services publicising best practice examples;

2. Establish or support a portal service for information on cultural and legal issues related to cross-border e-business (both digital and tangible products), documenting cultural diversity in Europe as a whole and the individual European countries, as a reference source for industry;

3. Create a specific cluster activity in the eContent or the Information Society Technologies (IST) programme to develop best practice guidelines for quality control aspects in localisation and translation processes.

CEN should, on a strategic level:

1. Conduct a publicity campaign creating greater awareness in European industry on the market approach to ICT standardization that CEN has developed in recent years in CEN/ISSS, publicising results and highlighting benefits for industry of involvement in CEN/ISSS activities;

2. Establish a CEN/ISSS activity to co-ordinate work in the area of cultural diversity, map the various activities in standardisation around the world related to cultural diversity, and reinforce or establish liaisons with the major international platforms to ensure global synergy with proposed future CEN/ISSS activities;

3. Build strong links with LISA and other industry platforms to ensure input from industry and create a platform for dissemination and take-up of the proposed CEN/ISSS activities.

CEN/ISSS should, on a practical level:

1. In co-operation with LISA, establish a Workshop to define extensions that can be added to various XML formats to incorporate support for localisation and translation tools;

2. In co-operation with the IST sector of Human Language Technologies (HLT) and the eContent programme, establish a Workshop concerning exchange formats for vocabularies and investigate the possibilities to establish a Workshop on standardisation of speech recognition technologies;

3. Establish a Workshop to collect experience and prepare and disseminate guidance material for implementation of the Universal Multi-byte Coded Character Set (UCS, ISO/IEC 10646) in back-end systems and databases;

4. Ensure the explicit inclusion of cultural diversity aspects in current and future activities in the CEN/ISSS Electronic Commerce Workshop and other Workshops related to Information Society Technologies.

6. References

[1] CEN – European Committee on Standardisation. http://www.cenorm.be/

[2] European Commission, Directorate-General Enterprise. http://www.europa.eu.int/comm/dgs/enterprise/index_en.htm

[3] ISO/IEC JTC1 N4627, excerpt at http://www.itscj.ipsj.or.jp/caw/j1n4627ex.htm

[4] ISO – International Organization for Standardization, http://www.iso.ch/

[5] IEC – International Electrotechnical Commission, http://www.iec.ch/

[6] ETSI – European Telecommunications Standards Institute, http://www.etsi.org/

[7] NISO – (U.S.) National Information Standards Organization, http://www.niso.org/

[8] JISC – Japanese Industry Standards Committee, http://www.jisc.org/

[9] IETF – Internet Engineering Task Force, http://www.ietf.org/

[10] W3C – World Wide Web Consortium, http:/www.w3.org/

[11] Unicode Consortium, http://www.unicode.org/

[12] ECMA – Standardizing Information and Communication Systems, http://www.ecma.ch/

[13] LISA – Localization Industry Standards Association, http://www.lisa.org/

[14] ACM SIGCHI Intercultural Issues Links and Resources. http://www.acm.org/sigchi/intercultural/

[15] ACM – Association for Computer Machinery. http://www.acm.org/

[16] SIGCHI. ACM Special Interest Group on Computer-Human Interaction. http://www.acm.org/sigchi/

[17] Web Internationalization & Multilingualism Symposium, Seville, 20-22 November 1996. http://www.diffuse.org/oii/en/w3c-intl.html

[18] JTC 1 Cultural Adaptability Workshop, 1998-01-20/22, Ottawa, Canada. http://www.itscj.ipsj.or.jp/caw/

[19] IWIPS – International Workshop on Internationalization of Products and Systems. http://zing.ncsl.nist.gov/iwips2000/ and http://webctr.net/IWIPS99/

[20] CHI 2000 Conference on Human Factors in Computing Systems. The Hague, The Netherlands, April 1-6, 2000. http://www.globalisation.org/sigchi2000/ and http://www.acm.org/sigchi/publications/#ACM_SIGCHI

[21] Consumer Requirements in ICT. ANEC, 1998 (under revision) http://www.anec.org/public/ict0607.htm

[22] Taking Account of Consumer Requirements. Report of Project To Study How Consumer Requirements May Be Taken Into Account By Standards. 1999. http://www.ict.etsi.fr/activities/consumers/INDEX.htm

[23] Design for All and Assistive Technologies. 2000. http://www.ict.etsi.org/activities/Design_for_All/INDEX.htm

[24] eContent Localisation. SPICE-PREP II, Export potential and linguistic customisation of digital products and services. Prepared by EPS Ltd. and Equipe Consortium Ltd. October 2000. http://www.hltcentral.org/usr_docs/spice/spice_final_report.pdf

[25] Commission of the European Communities. Communication from the Commission: Unbundling Access to the Local Loop: Enabling the competitive provision of a full range of electronic communication services including broadband multimedia and high-speed internet. COM(2000) 237. http://europa.eu.int/comm/competition/liberalization/telecom/local_loop/com_2000_237_en.pdf

[26] W3C Internationalization (I18N) / Localization (L10N). http://www.w3.org/International/

[27] TMX – Translation Memory exchange. LISA Special Interest Group OSCAR (Open Standards for Container/Content Allowing Re-use). http://www.lisa.unige.ch/tmx/index.html

[28] ISO/IEC JTC1/SC2/WG2. ISO/IEC 10646 UCS. http://wwwold.dkuug.dk/JTC1/SC2/WG2/

[29] ISO/IEC JTC1/SC22/WG20. Internationalization. http://wwwold.dkuug.dk/jtc1/sc22/wg20/

[30] ISO/IEC TR 11017 - Framework for Internationalization. http://wwwold.dkuug.dk/jtc1/sc22/wg20/docs/standards#11017

[31] ISO/IEC 15897 - Procedures for registration of cultural elements. http://wwwold.dkuug.dk/jtc1/sc22/wg20/docs/standards#15897

[32] CEN TC304. Information and Communication Technologies - European Localization Requirements. http://www.stri.is/tc304/

[33] ISO 14652. Information Technology - Specification Method for Cultural Conventions. http://anubis.dkuug.dk/JTC1/SC22/WG20/docs/fcd14652.txt

[34] ISO 10646. Universal Multi-Octet Coded Character Set. http://anubis.dkuug.dk/JTC1/SC2/WG2/

[35] The Unicode Standard. http://www.unicode.org/unicode/standard/versions/enumeratedversions.html

[36] ISO/IEC 8859. Information technology -- 8-bit single-byte coded graphic character sets. http://www.terena.nl/multiling/ml-docs/iso-8859.html

[37] CEN TC304. Multilingual European Subsets of ISO 10646-1 (MES-1, MES-2 and MES-3). http://www.stri.is/tc304/p10_1998_05_30.pdf

[38] W3C. Requirements for String Identity Matching and String Indexing. Working Draft 10-July-1998. http://www.w3.org/TR/WD-charreq

[39] ISO/IEC DIS 14651. Information technology - International string ordering - Method for comparing character strings and description of a default tailorable ordering. http://anubis.dkuug.dk/jtc1/sc22/wg20/docs/n731-fdis14651.pdf

[40] ENV13710. European Ordering Rules. http://www.stri.is/TC304/EOR/eor4r.pdf

[41] Unicode Collation Algorithm. 2000. Unicode Technical Standard #10. http://www.unicode.org/unicode/reports/tr10/

[42] Byrum, John D. ISO 639-1 and ISO 639-2: International Standards for Language Codes. ISO 15924: International Standard for names of scripts. See: http://www.ifla.org/IV/ifla65/papers/099-155e.htm

[43] IETF RFC 1766 (1995). Tags for the Identification of Languages. http://www.ietf.org/rfc/rfc1766.txt

[44] ISO 3166:1993. Code for representation of names of countries. http://www.din.de/gremien/nas/nabd/iso3166ma/

[45] Ethnologue. Languages of the World. http://www.sil.org/ethnologue/

[46] Constable, Peter and Gary Simons. Language identification and IT: Addressing problems of linguistic diversity on a global scale. SIL Electronic Working Papers 2000-001, September 2000. http://www.sil.org/silewp/2000/001/SILEWP2000-001.html

[47] HLTCentral. Observatory of Human Language Technologies on the Web. http://www.hltcentral.org/

[48] EAGLES – Expert Advisory Group on Language Engineering Standards. http://www.ilc.pi.cnr.it/EAGLES96/home.html

[49] ISLE – International Standard for Language Engineering. http://www.ilc.pi.cnr.it/EAGLES96/isle/ISLE_Home_Page.htm

[50] SALT – Standards-based Access to multilingual Lexicons & Terminologies. http://www.loria.fr/projets/SALT/

[51] OLIF – Open Lexicon Interchange Format. http://www.otelo.lu/

[52] ISO 12200:1999 Computer Applications in Terminology - Machine-Readable Terminology Interchange Format (MARTIF): Negotiated Interchange.

[53] ELRA Multilingual Lexicon. http://www.icp.inpg.fr/ELRA/cata/text_det.html#multilex

[54] ELRA – European Language Resources Association. http://www.icp.inpg.fr/ELRA/home.html

[55] Eurodicautom, the multilingual terminological database of the European Commission's Translation Service. http://eurodic.ip.lu/

[56] Eurovoc. http://www.eur-op.eu.int/opnews/496/en/r373.htm

[57] Agrovoc. http://www.fao.org/agrovoc/

[58] Population Multilingual Thesaurus. http://www.cicred.ined.fr/thesaurus/integral/

[59] GEMET. http://www.mu.niedersachsen.de/cds/etc-cds_neu/software.html#GEMET

[60] Multilingual Egyptological Thesaurus. http://www.ccer.ggl.ruu.nl/thes/thesaur.html

[61] ELRA Terminology resources. http://www.icp.inpg.fr/ELRA/cata/tabterm.html

[62] ELRA – European Language Resources Association. http://www.icp.inpg.fr/ELRA/home.html

[63] BSR – Basic Semantics Registry. http://forum.afnor.fr/afnor/WORK/AFNOR/GPN2/TC154WG1/index.htm

[64] ELSNET – European Network of Excellence in Human Language Technologies. http://www.elsnet.org/

[65] ISO 9241 Ergonomics requirements for office work with visual display terminals (VDTs)

[66] Stewart, Tom. Ergonomics user interface standards: are they more trouble than they are worth? http://www.system-concepts.com/stds/standards.pdf

[67] Nielsen, Jakob (ed.). Designing User Interfaces for International Use. Elsevier Science Publishers, 1990. ISBN 0-444-88428-9.

[68] Nielsen, Jakob. Designing Web Usability: The Practice of Simplicity. New Riders Publishing, Indianapolis, 2000, ISBN 1-56205-810-X, http://www.useit.com/jakob/webusability/

[69] Pemberton, Steven. No Such Number, No Such Zone. ACM SIGCHI 27(1), January 1995. http://www.acm.org/sigchi/bulletin/1995.1/views.html

[70] Maner, Walter. Internationalization of user interfaces. 1997. http://web.cs.bgsu.edu/maner/uiguides/internat.htm

[71] Decamp, Jennifer. Designing Systems for Global Users. Course notes, 1998. http://www.american.edu/academic.depts/ksb/mogit/decamp/syllabus98.html

[72] Lerner, Michael. Building worldwide Web sites: Make sales (or just friends) with a Web site that speaks the visitor's language. September 1999. http://www-4.ibm.com/software/developer/library/web-localization.html

[73] Microsoft Professional Developer's Site for Software Globalization Information. http://www.microsoft.com/globaldev/FAQs/Locales.asp

[74] Mozilla Internationalization & Localization Guidelines. http://www.mozilla.org/docs/refList/i18n/

[75] Read Me First! A Style Guide for the Computer Industry. Sun Technical Publications. ISBN 0-13-455347-0. http://www.sun.com/books/catalog/EdStyle/

[76] W3C Web Accessibility Initiative. http://www.w3.org/WAI/

[77] Design for All and Assistive Technologies. ICT Standards Board, 2000. http://www.ict.etsi.org/activities/Design_for_All/INDEX.htm

[78] Government of Canada Internet Guide. http://www.canada.gc.ca/programs/guide/main_e.html

[79] Treasury Board of Canada. Common Look and Feel for the Internet. http://www.cio-dpi.gc.ca/clf-upe/

[80] CEN/ISSS Workshop on Electronic Commerce. http://www.cenorm.be/isss/Workshop/ec/Default.htm

[81] W3C Micro Payment activity. http://www.w3.org/ECommerce/Micropayments/

[82] IBM Micro Payment. http://www.hrl.il.ibm.com/mpay/

[83] Cybercash. http://www.cybercash.com/

[84] Digicash. http://www.digicash.com/

[85] Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market ("Directive on electronic commerce"). http://europa.eu.int/ISPO/ecommerce/legal/legal.html#frame

[86] Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a Community framework for electronic signatures. http://europa.eu.int/ISPO/ecommerce/legal/digital.html