Browsing WWW Pages with Pictographic Content

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Abstract

This paper presents a WWW browser built with the aim of making WWW pages accessible to handicapped users lacking reading and/or writing capabilities. The browser accepts pictograms as the specification for queries and returns and displays results in the user's pictographic language. The browser has the capability of saving the addresses of favourite and most recently visited pages and is also able to display specially constructed pictographic pages written in languages other than the user's. Such pages are displayable by common browsers.

K.4.2 [Social Issues]: Assistive Technologies for Persons with Disabilities, Handicapped Persons Special Needs
H5.2. [User Interfaces]: Interaction Styles, User-centred Design
H.5.3 [Group and Organization Interfaces]: Web-based interaction

1. Introduction

Severely handicapped persons usually lack reading, writing and even speaking capabilities as it is the case of medium to severe forms of cerebral palsy. Also, some persons may loose their reading and writing capabilities during lifetime due to health or physical accidents, all the while retaining the capacity to think and the need to communicate.

However, even such persons are eager for information, be it very simple or in the form of news or stories, but are unable to tap into the vast wealth of information on the World Wide Web. This is because that information is mostly textual, i.e., unsuitable for their "reading" abilities, and the figures on WW pages may not be enough for their understanding mainly because they only carry part of the meaning of the page.

Overcoming language handicaps by providing such persons with substitute communication means has been at the root of the development of simplified languages based on graphics or pictograms. Several such languages that differ in complexity and number of terms defined are now in current use.
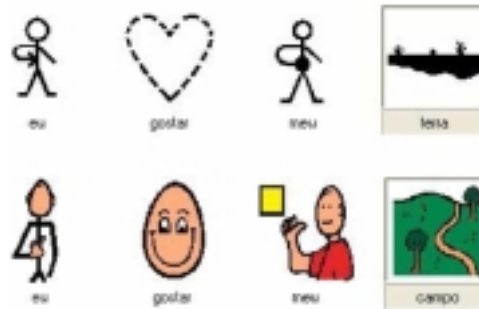

Figure 1: *Pictographic languages Makaton (above) and PCS (below), showing pictogram translation.*

The most commonly used pictographic languages are: PCS (Picture Communication System [PCS]), Makaton [MAK], PIC (Pictogram Ideogram Communication [PIC]) and Bliss [BLI].

These languages differ in number of pictograms defined and graphical design. While Makaton (see Figure 1) defines more than 4000 pictograms that present simplified graphics while including such notions as past, present and future, a language such as PCS uses more elaborate graphics but reduces all verb tenses to infinitive. PIC is still

more basic both in terms of graphics and number of pictograms.

Usually, a disabled person learns only one pictographic language and, more often than not, knows no more than a reduced number of pictograms. This means that such persons are unable to understand any "text" written in a pictographic language other than the one they know, thus creating islands separated by language barriers.

This paper presents a browser making normal WWW content (in Portuguese only) accessible to severely handicapped persons while, at the same time, allowing such persons to access WWW content originally available in pictographic languages other than the pictographic language they know.

2. User Needs

Previous work on software to be used by persons with severe disabilities lead to the development of a computer based communication tool (Comunicando [PAB02]) that allowed two persons to communicate in real time using a common pictographic language. Any two such users were also restricted to use the smallest common pictogram set of that language so that each one could understand all the other was "saying". Sentences were necessarily short and, although possible, it was nevertheless unpractical to tell a story or describe an event, let alone store the whole "text" for later public and/or restricted "reading".

The solution for this was to create WWW pages with pictographic content following construction rules making it possible to view such pages with a current browser. However, this would leave several problems yet to solve:

- Pages written in a given pictographic language would not be available to persons unfamiliar with that language.

- Any current WWW page could not be presented using a given pictographic language.

- Pictograms combine an image and its associated text (a word or a sentence) that may have to be spoken (common browsers lack such a facility).

- More often than not, handicapped users are unable to manipulate mice and the software must thus support interaction through other devices and/or means, namely through sweep techniques.

- Different users and handicap levels translate into different requirements that must be reflected into different browser behaviour and appearance to adapt to individual needs.

The above requirements highlight the need for a browser supporting all those features. Furthermore, as the need for adaptation could be supported through the existing user profiles of the RECRIA system, it was only logical that the browser to use had to be embedded into that system as one more component of the system's client.

3. The Navegando Browser

The following presents briefly the RECRIA system and, at length, the browser (Navegando) that was built to meet the user requirements.

3.1 RECRIA System

The RECRIA system ([SF03], [PB03]) is a client-server system designed to support users with disabilities that provides support for learning pictographic languages and use them to communicate through networked computers. Several games are also available. In some of them, virtual reality trains users to carry out daily tasks while others simulate games played by persons with disabilities. A WWW editor allows therapists and users to create WWW pages with pictographic content displayable by Navegando [CS05].

All client applications and games adapt to users through very complete user profiles defining user preferences and needs in terms of types of interaction, interaction devices, size and colours of graphical objects, proficiency levels, and assistance and help required. Agents and animated characters provide assistance to users by speaking out instructions and encouragements.

3.2 Browser requirements

The Navegando pictographic browser [BS04] had to be able to display the following types of pages:

- Pages using pictograms and built in strict obedience to HTML syntax in order that such pages might be displayed by current browsers and indexed by current indexing engines.

- Ordinary WWW pages whose textual content would be translated into pictographic content at display time.

Moreover, the browser had to be able to provide the user with the ability to specify queries and display query results in a pictographic way. The user should also be able to select a page to view from such a list and also:

Save the URL of a page just viewed as a favourite page, classifying it into a small numer of categories (stories, sports, handicaps and other).

- Save a list of the most recently visited pages.

- Scroll through a page or a list of pages (the most recently visited, the favourites list or the list returned by a query).

Figure 2: *First Navegando screen.*

Figure 4: *Navegando search words selection.*

Figure 3: **Navegando theme selection screen.**

Figure 5: *Search results headlines display screen.*

3.3 Browser Operation

When the users starts Navegando [TR05] from the list of applications available from the RECRIA system, it displays a dialogue for the user to select whether to search for pages on the WWW or from the local server, select a page from the favourites or from the list of the most recently visited pages (see Figure **2**).

If the user chooses to search for a page, a dialogue prompts the user to select the theme of the pages to look for from a short list of themes (Figure 3). Once the user selects a theme, a new dialogue is shown. This dialogue (Figure 4) prompts the user to specify one or several pictograms corresponding to the words to be used in the search.

The layout and interaction of this dialogue replicate those of the RECRIA's communication tool, Comunicando, since system users are supposed to be acquainted with this communication tool. The dialogue allows users to select a series of pictograms, hear the voice output of the pictograms' meaning and signal the browser to start the search.

Search requests restricted to pages in Portuguese are sent to the Google engine. The browser waits for the search engine response and then displays the headlines (titles) of the pages returned using pictograms as Figure 5 shows (the text translation into pictograms will be described later on). A pictographic translation occurs if search results return headlines of pages written in pictographic languages other than the user's.

This is the same dialogue reached by users who select to view a favourite or a recently visited page. Users are first prompted to select a page category and then shown the list of pages fitting that category.

Finally, the user selects one page to view and the browser displays it (Figure 6). A translation process similar to the translation process of titles occurs if the page is a normal WWW page or is written in a pictographic language other than the user's pictographic language.

Only three lines of "text" are displayed at any one time. To view other lines not currently shown, the user has two buttons for scrolling through lines on the left side of the display.

Figure 6: *Navegando displaying a story. Only three lines are shown at any one time.*

3.4 From Text to Pictograms

To translate the headlines' text returned by a query (or the text of a WWW page) into pictograms it is necessary to parse the text, discarding particles first. This is done by Smorph [HAG] that returns the syntactical role of the words in the text, thus allowing mapping all relevant text words in the headlines into the syntactical categories defined by pictographic languages.

Next, the catalogue of pictograms is searched for pictograms matching the words or expressions left after processing by Smorph. A pictogram is selected if a match is found. If not, the browser contacts an on-line dictionary for synonyms and repeats the matching process.

3.5 From a Pictographic Language to Another

Translation from one pictographic language to another is not a straightforward process. As it was said before, some languages present synonyms, expressions and various verb tenses while others do not.

Therefore translation must be carried out on the basis of the infinite tense of verbs (the only tense common to all languages) and, once again, supported by querying an on-line dictionary service. No syntactical analysis is necessary because all pictograms under the RECRIA system are classified according to their syntactical role.

4. Concluding Remarks

A pictographic browser, Navegando, to be used by severely handicapped persons and capable of displaying pages with pictographic content has been presented.

The browser, integrated in the RECRIA system, adapts to the user profile (sizes, colours, interaction, etc.) the system provides and is able to translate normal WWW pages into pictographic Web pages as well as from one pictographic language to another.

This browser is an important step to make WWW content accessible to handicapped users lacking the capability of reading and writing as usability tests carried out so far show.

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