First user test results with the predictive typing system FASTY

C. Beck, G. Seisenbacher, G. Edelmayer, W.L. Zagler

fortec – Research Group on Rehabilitation Technology,
Institute "integrated study", Vienna University of Technology,
Favoritenstraße 11/029, A-1040 Vienna, Austria
{beck, seisenbacher, edelmayer, zagler}@fortec.tuwien.ac.at

Abstract. This paper gives a brief overview about the partially EU funded project IST-2000-25420 FASTY in the IST program. The objective of FASTY was the creation of a system for increasing the text generation rate of disabled persons by Predictive Typing and dedicated advanced input devices. The system was developed for the Dutch, French, German, and Swedish language, the concept, however, is useable for most European languages. Some results from the user tests with the first prototype during the year 2003 are shown herein and were used to build the second and last prototype. A commercial version of the FASTY software is expected to be available in the second half of 2004.

Introduction

Motor impairments make the use of standard text input devices to the computer difficult and hence slow. But motor impairment often goes together with articulatory deficiencies. Therefore, communication often relies on slow text-input and that leads to communication disorders and negatively influences the quality of life.

FASTY assists motor, speech, learning and language impaired persons to produce texts faster, with less physical/cognitive load and with better spelling and grammar. FASTY is configurable for different types of disabilities, different communication settings and different European languages. It allows easier access to PC-based office systems, to modern forms of IT communication and a faster usage of text to speech synthesizers for voice communication.

Aims of the project

The concrete goal of FASTY was the creation of a system for increasing the text generation rate of disabled persons by so-called predictive typing and dedicated advanced input devices. A prediction system attempts to predict subsequent portions of the text by analyzing the text already entered and using frequency data on the vocabulary of the language. Character-by-character text entry is thus enhanced by the

possibility of entering whole words and portions of words as they are proposed by the system. The selection of an alternative should be made by means of a single keystroke. Complementary to the presentation of the suggestions on the screen, they will be read aloud by means of speech synthesis. The success of a system of this kind can be measured in terms of keystrokes that are saved using the predictions as compared to traditional character-by-character input. FASTY aimed at a keystroke saving rate (KSR) above 50%. Laboratory tests with the language part without the user interface showed, that this goal was even exceeded[1]! Additionally, experience gained during the first project year indicates that the linguistic quality of the text will also benefit from using the prediction system.

The FASTY text prediction system currently applies to four languages: Dutch, French, German and Swedish. The future inclusion of additional languages is desired. The multilingual aspect is reflected in the design of the system. Currently, Italian resources are under development[2] and first contacts for Romanian have been established.

An important aspect of the project is the design and development of a dedicated user interface adapted to the needs of the users. The user interface design and the features of the predictor program aimed at a wide coverage of primary users (various disabilities) and secondary users (various roles in supporting the disabled person).

Innovative and ergonomic user interfaces for various existing input methods (standard keyboard, on-screen keyboard, …) were developed together with the predictor (or are incorporated by an open system structure) thus minimizing time and effort for selecting the desired word from a selection list presented on the screen. In addition, a special pressure sensitive switch/keyboard has been developed and will improve the user interface (UI).

The FASTY System

The FASTY System is divided into a runtime part (for the daily use of the primary user) and an adjustment part, which is used to adjust the system to the needs of the primary user (with or without the help of a care person); additional developer tools are shown in Fig. 1, too.

[1] see Fig. 4 and [6] for details

[2] A first beta version of Italian is already available since April 2004

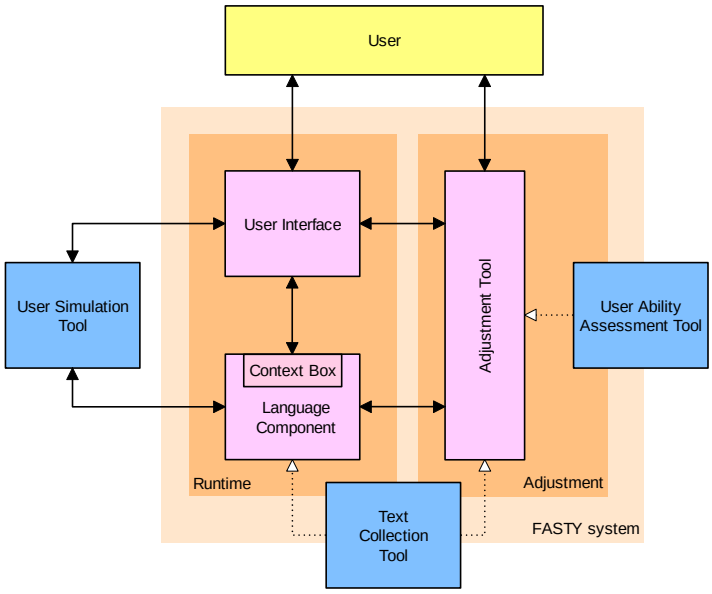

Fig. 1. General System Structure

The User Interface consists of a modular software package and optional pressure sensitive hardware devices, such as pressure sensitive single switches and some types of pressure sensitive keyboards (see Fig. 2).

Fig. 2. Pressure sensitive keyboard

These devices are connected to the computer via a serial connector and an interface box which was also developed (see Fig. 3).

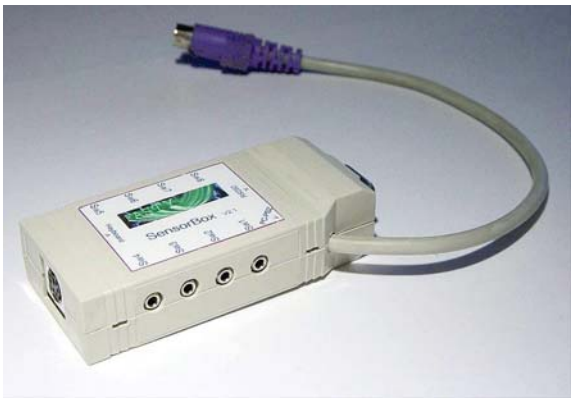

Fig. 3. Interface box for pressure sensitive single switches

The Language Component is a modular, nearly complete operating system independent software package, whose functionality is provided by a statistic language model based on word n-grams and part-of-speech tag n-grams in conjunction with one another. Moreover, the possibility to create user specific dictionaries both during a session and on the basis of previously entered texts, serves as a method for further increasing the prediction accuracy. As an example, the results for the German language are shown in Fig. 4. For a detailed description of the complex interaction of the different prediction modules and the structure of the modules themselves, see [1][2][3], for a more detailed view of the results, see [6].

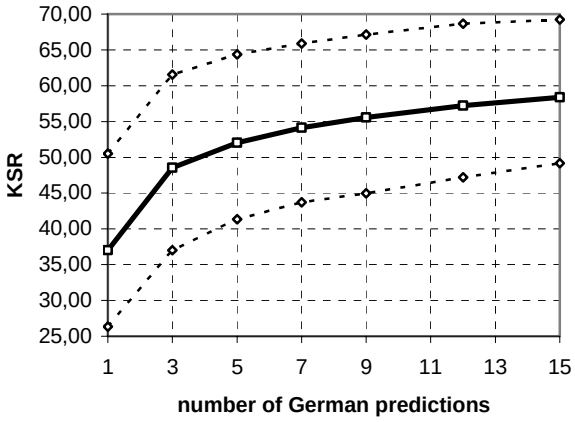

Fig. 4. KSR versus shown predictions for the German language during laboratory tests (the solid line shows the average, the dotted lines are the minimum and maximum KSR)

Concerning the development of the FASTY System [4][5][6], the second prototype (see Fig. 5) is ready and the evaluation of the second user test results are nearly done.

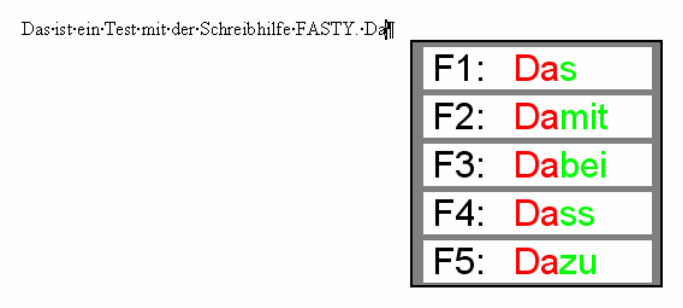

Fig. 5. Screenshot of FASTYs prototype 2 user interface during writing German

Innovations of FASTY

There are a number of word predictors on the market. However, they have, typically, been developed for English, which means that they are not well suited for morphologically rich languages such as Dutch, French, German and Swedish. Simply adapting the English programs to these highly inflecting languages by replacing the English dictionaries usually implies a massive reduction of keystroke saving rate. These effects are due to the simplistic language description that is used for predicting English text and that fails to predict the correct inflectional form of a word as required by inflectional languages. The English language description is, as a rule, limited to frequency data on individual words (unigrams) and sequences of words (bigrams, trigrams). Attempts have been made in research systems for Swedish and Spanish to use a more elaborate language description, including n-grams of word classes and syntactic grammars. The experiences made in these projects are taken into account in the FASTY project. They do not, however, present solutions that will ensure a keystroke saving rate of above 50% for the FASTY languages. An additional problem with most of the FASTY languages is the fact that new compounds can be created on the fly, thus making it hopeless to strive for a complete lexicon. Other methods were employed for coping with dynamic word formation processes. Being able to cope with compounds, even if they are new, is of great importance, since compounds are usually rather long words and failing to predict them can cause a significant drop of the keystroke saving rate. Since no word prediction system currently available is able to handle new compounds, this aspect of the FASTY system is a true innovation.

In particular, the innovative nature of the FASTY system is reflected in the following features:

- prediction of compounds
- prediction of proper inflectional forms based on the use of parsing
- generic algorithms to ensure cross-language portability
- dictionaries based on general language corpora and on the users' own texts
- adaptation of the dictionaries based on actual use of the predictor

- initially supported languages: Dutch, French, German, Swedish
- user interface that is an integral part of the prediction system and
- new input device (such as pressure sensitive switches and pressure sensitive keyboards)

User tests results

The user tests with the first prototype were carried out from April to June 2003 in four countries (Austria, Belgium, Germany and Sweden) testing all four prediction languages. The user feedback was given in form of weekly reports about bugs, problems and highlights, which were summed up and evaluated in reports [7][8].

Most user results dealt with bugs in the prototype and the problems, which arose from them for the users. All in all 262 bugs were discovered and thus, five updates were delivered to the users in the form of small patches within the test phase.

Technical feedback was given in the form of log files (see Fig. 6), which contains statistical data about the prediction process and the interaction of the user with the user interface. Consequently, the predictor and the interaction with the user interface were improved for the second prototype based on this statistical data.

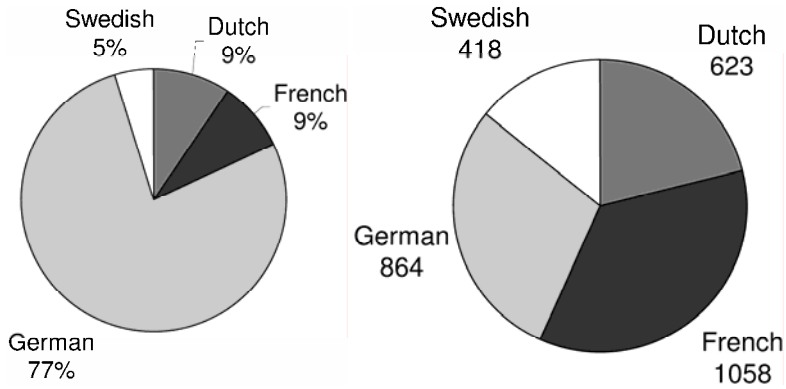

Fig. 6. Distribution of log files across language (left), average characters per log file (right)

One of the general results of the user tests was that the users will have to learn to use the system (as described), but this learning process is not as hard as expected. Fig 7 shows the writing speed versus the time of the test. The writing speed increases only slightly within the 5 weeks of testing.

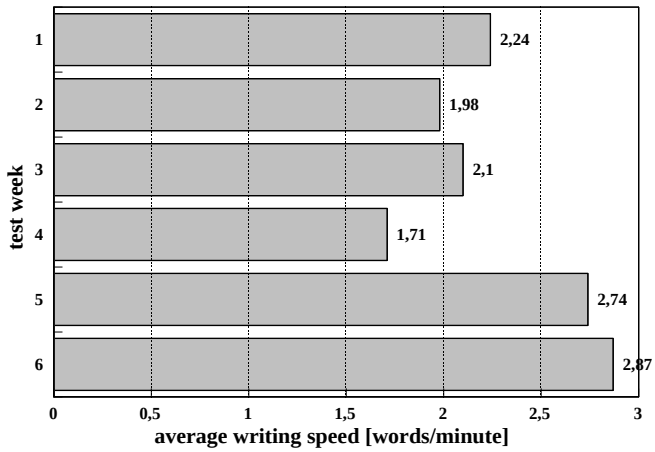

Fig. 7. Writing speed (in words/minute) versus time of the tests for German users

The actually reached KSRs of the tests with the first prototype are shown in Fig. 8. They differ from the values from the laboratory tests, because the users had to get used to the system, the users not always chose the available predictions and due to many bugs in the user interface of the first prototype.

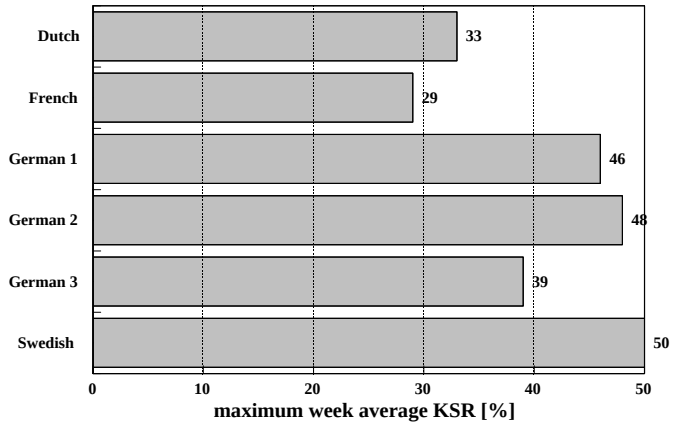

Fig. 8. KSRs reached during the user tests done with the first prototype[3].

[3] There were three different German user groups in Austria and Germany and they are marked with German 1 to German 3

Additional Information

More information about the project and the current state of the commercial version can be found on the web at: http://www.fortec.tuwien.ac.at/fasty

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