FASTY – Faster and easier text generation for disabled people

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predictive typing, enhancing text input
user interface developing, empowering disabled people

Abstract: The partially EU funded project FASTY will assist motor, speech, learning and language impaired persons to produce texts faster, with less physical/cognitive load and with better spelling and grammar. Higher text generation rates will be achieved on one hand by using a very adaptable User-Interface with a variety of feedback options such as different selection lists and orders for the predicted words/phrases, different audible feedback options and synthetic speech output. On the other hand a very strong prediction engine, which is independent from the used language, is developed. Based on n-gram methods the engine will use Part-of-Speech statistics, grammar-based prediction and prediction ranking and collocation-based prediction, too. Furthermore, a new technique for compound prediction will enhance the keystroke-saving rate for some languages. The paper will give a general introduction to the project and a status report on prototypes. First results of language performance tests will also be presented.

1 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 influences the quality of life negatively.

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

2 Aims

The concrete goal of FASTY is 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 analysing 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 proposals 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 aims at a keystroke saving rate above 50%. Experiences that were made during the first project year indicate that the linguistic quality of the text will also benefit from using the prediction system.

The FASTY text prediction system 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 and first contacts for Romanian were established.

An important aspect of the project is the design and development of a dedicated interface adapted to the needs of the users. The user interface design and the features of the predictor program aim at a wide coverage of primary users (various disabilities) and secondary users (various roles in supporting the disabled person). Self-adapting parameters and flexible configuring should ensure a high degree of usability, user friendliness and accessibility to the system. A user simulation tool is used in testing the system and adapting it to different users.

Innovative and ergonomic user interfaces for various existing input methods (standard keyboard, on-screen keyboard, scanning) are developed together with the predictor thus minimising time and effort for selecting the desired word from a selection list presented on the screen. In addition, a special pressure sensitive switch/keyboard is developed and will improve the user interface (UI). Strategies for optimal exploitation of residual functions will be implemented.

3 The FASTY System

The FASTY System is divided in 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.

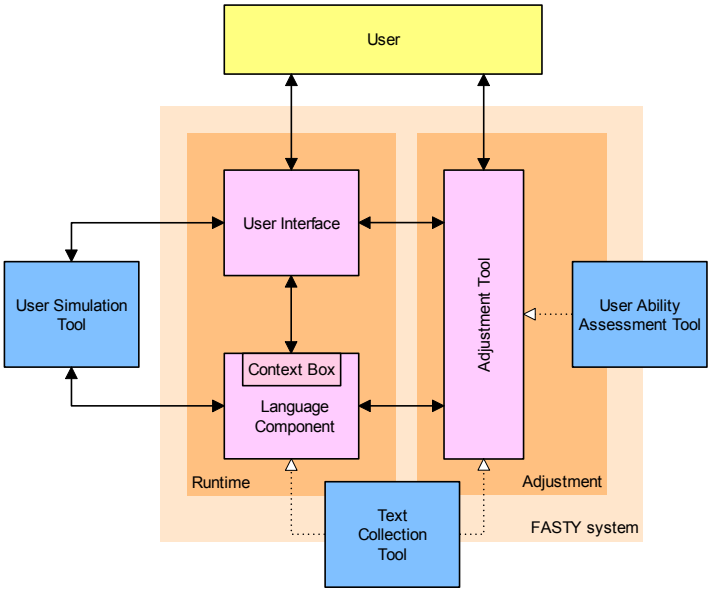

Fig. 1: General System Structure

The User Interface consists of a modular software packet and optional pressure sensitive hardware devices, such as pressure sensitive single switches and some kinds of pressure sensitive keyboards. These devices are connected to the computer via serial connector and an interface box, which was developed, too (see Fig. 2).

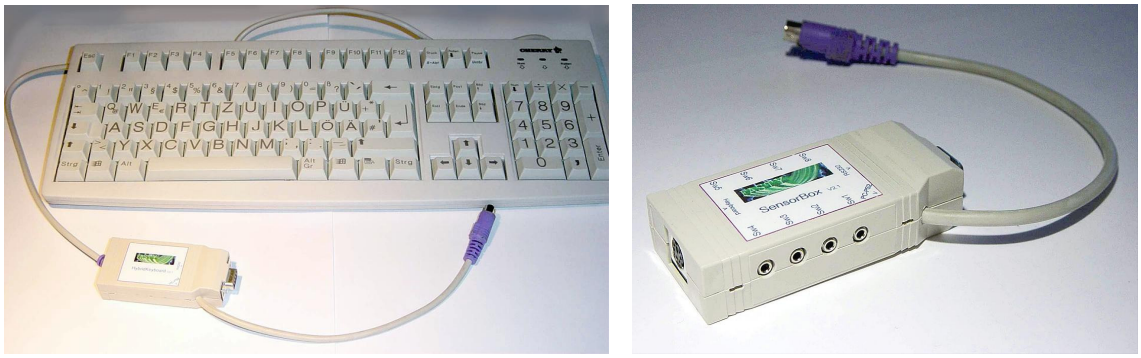

Fig. 2: Pressure sensitive keyboard (left) – interface box for pressure sensitive single switches (right)

The Language Component is a modular, nearly complete operating system independent software package, which functionality is provided by a statistic language model based on word n-grams and part-of-speech tag n-grams in conjunction. Moreover, the possibility to create user specific dictionaries both during a session and on the basis of previous entered texts, serves as a method for further increasing the prediction accuracy. Further, the use of topic specific lexica will be considered. For a detailed description of the complex interaction of the different prediction modules and the structure of the modules their selves, see [1][2][3].

The developer tools are ready and are used mainly during the development phase. The Text Collection Tool was used to collect text samples from disabled persons via internet or from their home computers. These text samples are used to support the dictionary generation and for tests with the User Simulation Tool with the developer versions of the FASTY system. The User Ability Assessment Tool was used to find out how persons use their current input devices.

Concerning the development of the FASTY System [4], the first prototype is ready and is tested by users with different disabilities and age in four countries in April and May. A second, improved prototype will be ready for user verification in September. The second prototype will be free distributed via internet; so feel free to test the result of this project yourself by downloading an evaluation system from http://www.fortec.tuwien.ac.at/fasty

4 First test results

Tests with the language part and a variety of settings can not be burdened to real users, because it is too work intensive especially for disabled slow typers, which are focused on by FASTY. Therefore the tests were done using a simulation tool that acts like a user interface with a user in front. The sensitivity to wrong user interaction (e.g. not selecting a correct predicted word, typos, …) can not be tested with such a simulation tool, but extensive writing of huge text amounts, including text, that was written by disabled users lead to good statistical data, which is used to optimize algorithms, settings and data.

The following results are done with the first release of the language module, which did not include all planned sub-modules and the used resources were not optimized. The first user tests started in April used enhanced resources and modules; the results will be available in the summer.

Different texts with different length and content (e.g. news, fairytale, diary style texts of disabled users, …) were used in all 4 supported languages to produce statistic data for later enhancements.

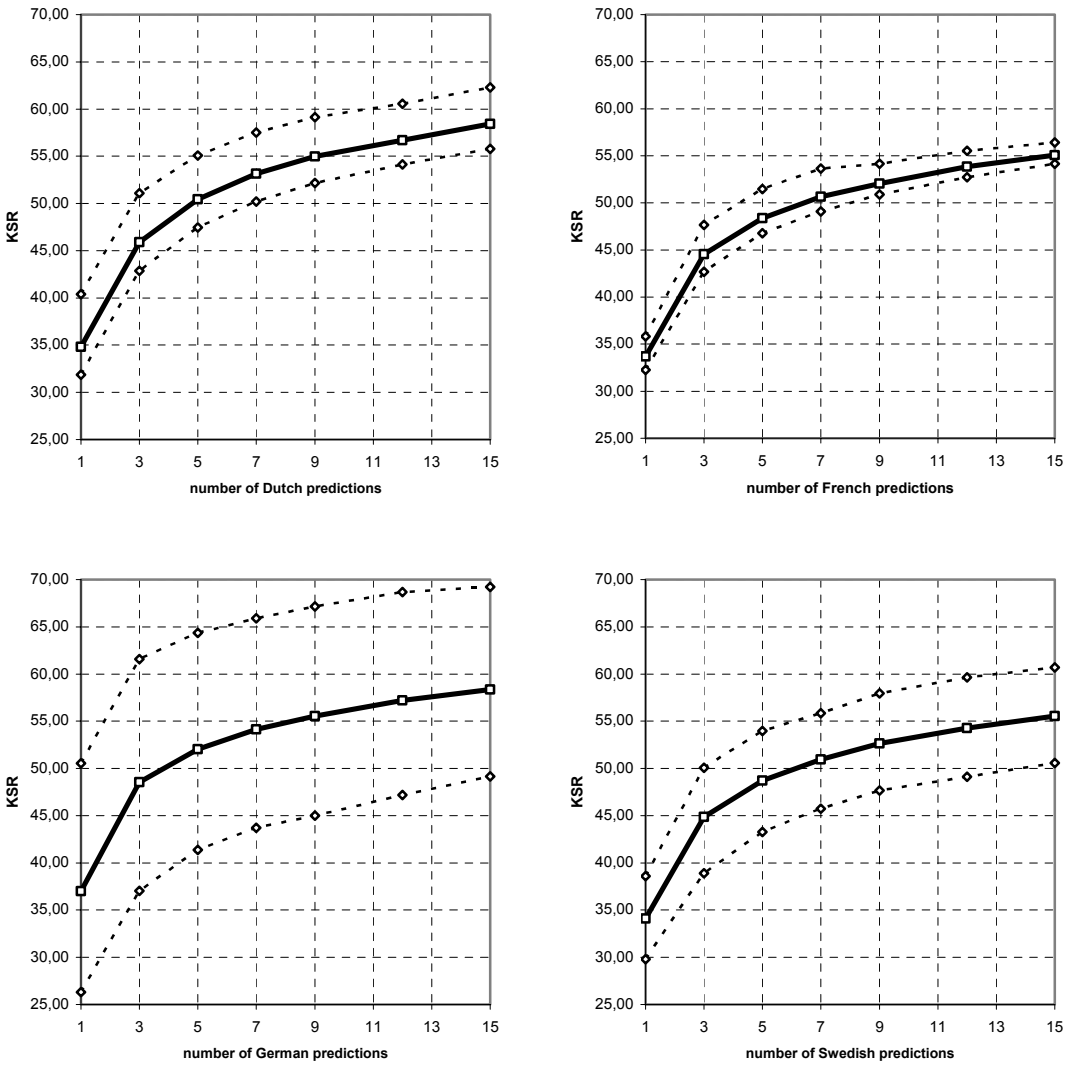

Fig. 3: Results of the simulations for all 4 languages, the bold line shows the average of all texts, the dotted lines minimum and maximum

Fig. 3 shows the results of the first performance tests with the FASTY prediction engine. The KSR is displayed versus the number of shown predictions in the prediction window for each currently supported language.

The FASTY prediction engine produces some 35% KSR with only 1 shown prediction; using common prediction lists with 5 predictions, the 50% KSR line is crossed. Additional, new user interfaces for the prediction list will enable the user to view 15 predictions in the same time as only 5 predictions. So FASTY will easily have some 55% KSR and with the planned additional modules FASTY will reach even the 60% KSR level for general texts. Further improvements of dictionaries, using abbreviation expansion and topic related dictionaries will bring additional gains in KSR for daily life texts.

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- Multitel ASBL (MULT)
- IGEL Elektronische Kommunikationshilfen GmbH
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More information about the project and the current state can be found on the web at: http://www.fortec.tuwien.ac.at/fasty
For questions about the project, please send an email to fasty-fortec@fortec.tuwien.ac.at.

References

[1] J. Matiasek, M. Baroni and H. Trost, "FASTY – a multilingual approach to text prediction", in Miesenberger K., Klaus J., Zagler W. (eds.): Computers Helping People with Special Needs, 8th International Conference, ICCHP 2002, Linz, Austria, July 15-20, Proceedings, pp. 243-250. Lecture Notes in Computer Science, Vol. 2398, Springer, Berlin-Heidelberg-New York.

[2] M. Baroni, J. Matiasek and H. Trost, "Predicting the Components of German Nominal Compounds", in: Harmelen F.van (ed.): Proceedings of the 15th European Conference on Artificial Intelligence (ECAI 2002), IOS Press, Amsterdam, pp. 470-474, 2002.

[3] M. Baroni, J. Matiasek and H. Trost, "Wordform- and class-based prediction of the components of the German nominal compounds in an AAC system", in: Proceedings of the 19th International Conference on Computational Linguistics (COLING 2002), Taipei, Taiwan. 2002.

[4] FASTY Consortium, "2nd Edited Annual Report – FASTY Project", 2003, http://www.fortec.tuwien.ac.at/fasty

[5] C. Beck, W.L. Zagler, "FASTY – Faster Typing for Disabled Persons", European Medical & Biological Engineering Conference (EMBEC 2002), Vienna, 2002