SIBYLLE, an Assistive Communication System Adapting to the Context and its User*

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In this paper, we describe the latest version of SIBYLLE, an AAC system that permits persons who have severe physical disabilities to enter text with any computer application, as well as to compose messages to be read out through speech synthesis. The system consists of a virtual keyboard comprising a set of keypads which allow for the entering of characters or full words by a single-switch selection process. It also includes a sophisticated word prediction component which dynamically calculates the most appropriate words for a given context. This component is auto-adaptive, i.e. it learns with every text the user enters. It thus adapts its predictions to the user's language and the current topic of communication as well. So far, the system works for French, German and English. Earlier versions of SIBYLLE have been used since 2001 in a rehabilitation center (Kerpape, France).

Additional Key Words and Phrases: Augmentative and Alternative Communication; Virtual keyboard; Word prediction; Latent Semantic Analysis; User adaptation; Keystroke saving rate

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1. INTRODUCTION

This paper presents SIBYLLE, an AAC (Augmentative and Alternative Communication) system for persons with severe speech and motion impairments (cerebrally and physically disabled persons, *Locked-in* syndrome, cerebral palsy etc.). Whatever the disease or impairment considered, oral communication is impossible for these persons who also have serious difficulties in physically controlling their environment. In particular, they are not able to use the standard input devices of a computer. Like other AAC systems, such as *FASTY* [Trost et al., 2005] or *Dasher* [Ward et al., 2000] SIBYLLE aims at restoring the communicative abilities of these persons.

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Many AAC systems have a very similar architecture, consisting of 4 components (Figure 1). At first, one finds a physical input interface connected to the computer. This device is adapted to the motion capacities of the user. When the latter must be restricted to a single switch (eye glimpse or breath sensor, for instance), the control of the environment is reduced to a mere Yes/No command.

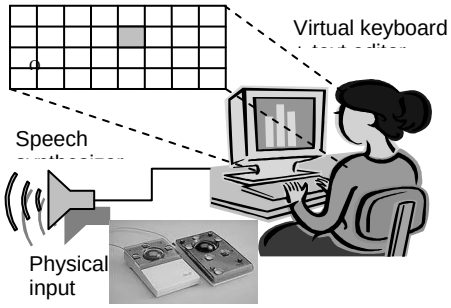

Fig. 1. Architecture of most AAC systems

Secondly, a virtual keyboard replaces the physical keyboard by displaying a table of symbols (words, letters or icons) on screen. It allows the user to select successively the symbols that will compose the intended message. In SIBYLLE, symbol selection is achieved by a linear scan procedure: a cursor successively highlights each key of the virtual keyboard which can then be selected by the user. The last two components are a text editor and a text-to-speech synthesizer, which is used to read out the typed message for spoken communication. SIBYLLE works for French, German and English, and it is usable with any *Windows*™ application (text editor, web browser, mailer...).

The main challenge of AAC systems results from the slowness of message composition. Whereas people can produce up to 200 words per minute in oral communication, persons using an AAC device cannot type more than 1 to 15 words per minute, depending on their abilities and the configuration of the system [Alm et al., 1992]; moreover, this task is very tiring.

We thus investigate two complementary approaches intended to speed up text input: fast key selection and keystroke reduction. These improvements are based on two prediction modules which will be described in this paper. At first, we present the user interface of our system. Sections 3 and 4 describe in detail the prediction modules which have been developed for SIBYLLE. In sections 5 and 6 we describe and evaluate the adaptation capacities of the word prediction component, which takes into account the user's way of speaking, as well as the current semantic context. Finally, we present some first results from user feedback and give a brief outlook on the following steps we plan to take in the development of our system.

2. SIBYLLE: THE USER INTERFACE

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