Multilayer Keyboard: transition toward a new optimized layout

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Abstract

Reorganization of a keyboard layout based on linguistic characteristics would be an efficient way to improve input text speed. However, a new character layout imposes a learning period that often discourages users. Bi [1] aimed at easing a new layout acceptance by sacrificing the long term performance. We propose a solution based on the multilayer interface concept to achieve the same goal without prejudicing the long term performance. By smoothing the learning period, these strategies reintroduce interest in alternative layouts.

Keywords

Input text, multilayer interface, layout, soft keyboard

ACM Classification Keywords

H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces – evaluation/methodology.

General Terms

Design, Experimentation

Introduction

In spite of several innovations [8] reaching a commercial step, the standard mini-QWERTY remains the preferred way, or at least the most spontaneous way, to input text with soft keyboards. Considering that several experiments demonstrated the lack of efficiency of the mini-QWERTY [2][4][5], [7], improving text input on soft keyboards remains an important challenge.

Based on the same observation, several researches [1][4] concluded on the relativity of the concept of performances: in a non-controlled context, reaching performances at long term implicates that users use the software at long term and do not abandoned it during the learning period. Thus, to be efficient, a keyboard should not only enable to reach good performances in the long term but it should satisfy users in the short term and encourage them to adopt the new artifact.

Among the solutions traditionally explored, the reorganization of keyboard layout as a function of linguistic characteristics should be a very efficient way to improve the performances of soft keyboard in the long term [2], [5], [7]. The reorganization of the layout reduces the distance between frequently paired characters. As a consequence of the overall distance reduction, the reorganization provides a time gain. However, a new layout disorients a user accustomed to a previous one. Indeed, the user is turned back into a beginner, and may not accept this situation.

In order to reduce this problem, Bi [1] proposed a compromise between obtaining performances at long term and maintaining the user's references during initial use: the quasi-QWERTY keyboard. The quasi-QWERTY keyboard optimizes the layout toward linguistic properties but allows only permutation of neighboring characters. Thus, the visual search of characters is eased for a mini-QWERTY user beginning with this new keyboard. During the first usages, Bi demonstrates better performances than performances with a layout freely reorganized, whereas the user still remains less efficient than with the mini-QWERTY.

We are convinced that this strategy of smoothing the transition from the QWERTY layout to another layout is promising, we propose and studied the concept of multilayer keyboard. Inspired by the concept of multilayer interface [3] used to smooth the transition between two versions of a system, the multilayer keyboard enables to progressively improve the layout by proceeding casual permutations converging through an optimal layout.

In a first section, we will detail the concept of multilayer interface and multilayer keyboard. Then, in a second section, we present a first evaluation of the keyboard investigating how users react to the casual permutations. Finally, we will discuss the constraints and perspectives for the multilayer keyboard.

Multilayer keyboard

Multilayer interface

The concept of multi-layer interface [6] was initially proposed to promote a universal access to software. It enables heterogeneous users with different skills and goal (amatory or professional objectives for instance) to use efficiently the same application. The interface is divided in gradual layers progressively increasing their complexity. For each layer, the number of accessible functionalities, their parameters and the ways to interact with the interface are adapted to a user expertise level and goals.

[3] revisited this concept to ease the transition between two version of an interactive system (particularly when this evolution of the software is confronted to the user's

reluctance). They applied it to ease the evolution of working methods in the air traffic control field. This time, a homogeneous population of air traffic controllers was supposed to adopt a new tool and to adapt their working method toward new collaboration paradigms. To smooth the transition and turn it easier to accept, the new software was divided in several layers. The first layer reproduced the original working method. The other layers accompany the users in the transition toward new ones. Every layer brings attractive new functionalities encouraging the user to adopt it.

Multilayer Keyboard

The Multilayer Keyboard is based on this concept of multilayer interface. The principal goals of the keyboard are: Maintaining the users complete efficiency with the keyboard during the whole time (no learning period must be needed); making the keyboard and the users evolving progressively during a transition period; stimulating the user to require the further evolutions.

Specifically, the concept implementation is based on the following observation. With a physical keyboard and some experience, a user can easily perform text input without looking at the keyboard. So, the permutation of two characters gets an important impact on the input. However, to input text with a soft keyboard a visual retro-control is needed. Thus, switching two neighbored keys should not have a deep impact on text input.

Based on the same observation, Bi [1] proposed the Quasi-QWERTY Keyboard. To obtain the final keyboard, he performed one round with several simultaneous permutations. As a consequence, the resulting keyboard layout does not enable to reach the performances obtained with a keyboard layout freely organized; the cost for a beginner is lower than the cost with a layout freely organized, but it remains significant due to the multiplication of the permutations performed simultaneously.

With the Multilayer Keyboard, we proposed to perform the permutations one by one and spaced in the time. The permutations enable to progressively improve the performances by reducing the distances between the characters frequently enchained in the language. When a user has completely absorbed the consequences of one permutation, the next one is performed. Thus, the user must learn one permutation at a time that should not have a significant impact on the key search. Moreover, permutation after permutation, we can progressively reach the configuration of a freely organized layout.

The transition period between the initial layout (QWERTY) and the final layout may be long. However, during this period, the user is supposed to: have a permanent domination of the current layout; to have no regression of his performance; and to progressively see improvements through the distance reduction permutations. Finally, the expectation is that the user perceives the progressive gain and begins to be involved in the evolution process by soliciting the further permutations.

Evaluation

We performed a first evaluation of the multilayer keyboard. It aimed at testing if the user was able to assimilate the permutations without prejudicing his performance and if the user was understanding the benefit of these permutations.

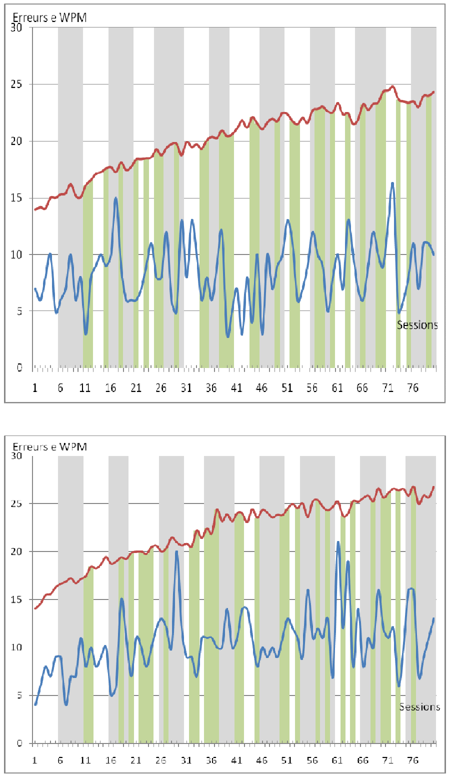

Figure 1: individual results for the two first users (in red the input speed, in blue the errors rate x4, the green bars identify the sessions when a permutation where performed, the gray and white bars identify the day alternations)

6 users performed 80 sessions (about 8 minutes per session at the beginning) at a rhythm of 5 sessions per day. During every session, each user input 10 short sentences. The 10 first sessions were performed with the QWERTY keyboard. 30 successive permutations were planned. During the further sessions, the user chose when to perform a permutation. They were not forced to do it.

Some results are illustrated figure 1. During the 80 sessions, every user performed the 30 planned permutations. As forecasted, between the 10th (beginning of the permutations) and the 80th session, they increased their input speed by 40% without the feeling to loose their complete domination of the keyboard at any time. No regression of the performances was noticed. The major criticism of the system was that, sometimes, the users would have performed the permutations in a different order. It proved their implication in the process and the perception of the permutation interest.

Discussion and conclusion

The quasi-QWERTY keyboard [1] and the Multilayer Keyboard reintroduced the interest of optimized layouts. However, they not only target the long term performance but also focused on maintaining acceptability of the new layouts.

The evaluations performed on the Multilayer Keyboard were done in a context favorable for the keyboard: a relative intensive usage (between 20 and 30 minutes per day). Mainly, they must be completed by other experiences where the keyboard will have to compete with the QWERTY keyboard during a long period. Nevertheless, they showed that the multilayer keyboard enables to break the QWERTY paradigm and to raise the enthusiasm for other layouts.

Moreover, they illustrate that if we performed one permutation every 6 months simultaneously on every soft keyboard, the whole population would improve its performances by 40% after 10 years without a real cost for anybody.

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