

TimeSlider: An Interface to Specify Time Point

Yuichi Koike Atsushi Sugiura Yoshiyuki Koseki
C&C Media Research Laboratories, NEC Corporation
4-1-1 Miyazaki, Miyamae-ku, Kawasaki 216, JAPAN
E-mail: {koike, sugiura, koseki}@mmp.cl.nec.co.jp

ABSTRACT

This paper introduces TimeSlider, a user interface technique that allows the user to specify time points. TimeSlider is a kind of slider whose time scale is nonlinear and which moves as a user operation. The nonlinearity enables it to display a long time range in a small space, and the movement as a user operation helps the user to specify time points quickly. An example application, in which TimeSlider enabled the user to restore past WWW pages, demonstrated the effectiveness of our technique.

KEYWORDS: Desktop software, time machine, selection technology, slider.

INTRODUCTION

We are currently developing a desktop system, called "Time Machine Desktop", which automatically records the history of changes on the desktop. With this desktop, users can restore any past desktop state, as if they were traveling back in time in a time machine. For example, if the user browses an online newspaper with a Web browser, the desktop records all the articles browsed so that the user can restore the past articles anytime by specifying the time point when they were browsed.

On such a desktop system, it is essential to select one target item from the huge number of items on the time line. One of the problems here is that the range of time is infinite. In most conventional selectors, such as AlphaSlider [1], the scale range corresponds to the range in which the items exist. However, the range of items can be changed in our Time Machine Desktop. In its e-mail system, for example, e-mail may arrive during user operation. Therefore, a technique to treat the changing range of items is needed.

TIMESLIDER

TimeSlider is a slider which allows users to specify a point in time by moving an indicator knob or clicking a point on the time scale.

Small marks: Small marks on the time scale represent the

time points when the desktop state changes. In the e-mail system, for example, the marks represent time points when the user receives e-mail. As another example, marks can represent time points when WWW pages are updated in a WWW browser. These small marks help the user to find time points in a long time range.

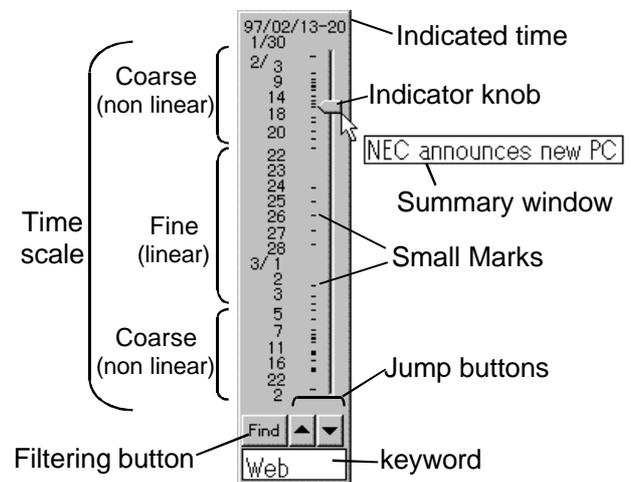


Figure 1: TimeSlider

Nonlinear time scale: In order to display a long time range in a small area, TimeSlider uses a nonlinear time scale. The time scale is fine and linear at the center part. And, unlike conventional sliders, the time scale is coarse and nonlinear (exponential) at the ends. In Figure 1, for example, one pixel corresponds to about two hours at the center of the scale and about 65 hours at the end of the scale. The time scale can display a total time of about two months.

Moving time scale: If the target time point is in the end part of the time scale, where the scale is coarse, it is difficult to specify it. To solve this problem, TimeSlider provides a method to bring the target time point to the center. When the user grasps the indicator knob, the time scale moves so as to bring the indicated time point to the center. When the indicator knob is in the upper part of the time scale the time scale moves downward, and when it is in the lower part, the time scale move upward (Figure 2).

In addition, since the range of time is infinite, the target time point may be out of the scale's range. In this case, the moving time scale enables the user to bring any time point

into the scale's range. In order to bring a time point far away from the scale's range into the range in a short time, the scale moves at a speed proportional to the time difference between the center and the point the knob indicates.

Users might become irritated if the scale moved whenever they grasped the knob, however. Thus, the TimeSlider's time scale starts moving only if the user grasps the knob and holds it stationary for a fraction of a second (i.e. about 0.3 second).

The operation with which a user selects a time point in the end part is as follows: 1) The user moves the indicator to the target time point in the end part. 2) The user stops the indicator at that point and holds it there. 3) After a fraction of a second, the time scale starts to move, and the target time point comes to the center part. 4) The user moves the indicator to the center and selects the target time point.

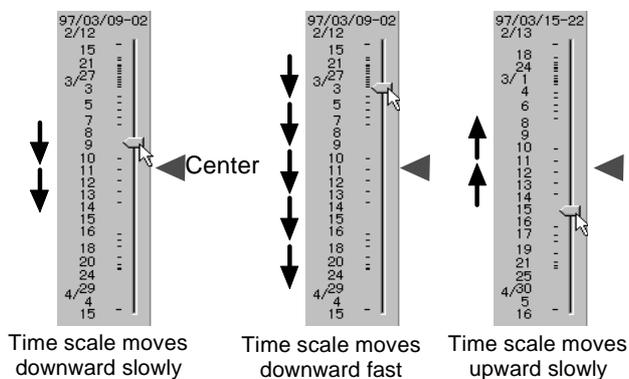


Figure 2: Nonlinear and Moving Time Scale

INTEGRATION WITH OTHER SEARCHING METHODS

Since users often cannot locate information by using the time attribute alone, integration with other searching methods is important. TimeSlider supports the following two methods:

Summary window: A summary window appears when the user grasps the indicator knob (Figure 1). It displays information about the desktop state and any changes which have occurred, e.g. "E-mail from Mr. so-and-so" for the e-mail system, or "Page summary: NEC announces new PC" for the WWW browser.

Keyword search: Figure 1 shows the "Find" button and the text field below the button used for this function. When the user types keywords into the text field and pushes the button, TimeSlider displays marks which correspond to points at which there are items which include the keywords.

DISCUSSION

In conventional selectors, such as Alphaslider, the user can not see the item distribution. In contrast, TimeSlider shows this distribution to the user by displaying small marks. When the user selects an item, he/she usually can not access the target item directly. It is necessary to focus

on the area near the target item first, and then select the item. In this case, the showing of the item distribution to the user is very helpful, especially when the user does not know the target's exact time point.

The combination of the two features of the time scale, i.e. its nonlinearity and its movement as a user operation, also helps the user select items. When the target time point is far away from the scale range, the user grasps the knob to bring the target point quickly into the range. If the scale were linear, it would be difficult to stop the fast moving target point at the center. In the nonlinear time scale, the target point moves slowly at the scale's end where the scale is coarse. Thus, the user can easily see the target point come into the scale range and reduce its speed.

The scale indexes of some conventional selectors, such as scrolling list, WING index view [2] or Alphaslider, are proportionally spaced to the number of items. A proportionally spaced index is effective when there is a fixed number of candidates. However, when candidates are changed by user operation such as keyword filtering, scale indexes may be moved. Since users usually recognize items' position by indexes, index movement may confuse them. Accordingly, TimeSlider's scale indexes are changed only when the user moves the scale explicitly.

EVALUATION

We did an experiment to evaluate TimeSlider's performance. The user's task in the experiment was to specify a single time point from out of 10,000 WWW pages covering a range of in about 27 years. The task was repeated 64 times by expert users; the mean time required to specify a time point was 13.3 seconds.

The mean time required for expert users to select an item from a list of 10,000 film titles using Alphaslider was 13-15 seconds [1]. Although the two tasks are different (i.e. one involved selecting from an alphabetically-ordered list, and the other selection from a chronologically-ordered one), the size of the lists were about the same, and thus it can be said that the performance of TimeSlider is at virtually the same level as that of Alphaslider.

CONCLUSION

This paper has introduced TimeSlider, a user interface technique that allows the user to specify time points. TimeSlider's use of a nonlinear time scale enables it to display a long time range in a small space, and the fact that its time scale is a moving one helps users to specify time points quickly. The next step in our research will be the development of a number of applications for TimeSlider.

REFERENCES

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