Richbiff: E-Mail Message Notification with Richer Clues

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Abstract. Traditional e-mail notification applications, which notify the user of newly arrived messages, are frequently insufficient because users daily receive a vast number of messages. Hence, we propose an e-mail notification application that peripherally displays summaries of messages in the form of kinetic typography. In addition, it infers the possibility of a message being read to control notification levels and conceals parts of words to avoid exposing excessive personal information. We have qualitatively confirmed the effects of the application through trial use; it can strongly attract users' attention and motivate the user to check significant messages.

Keywords: notification, kinetic typography, peripheral display, ambient display.

1 Introduction

As e-mail has become popular, people receive a vast number of e-mail messages daily and can find it annoying to check them. Simple notification applications or devices that inform the user of newly arrived messages are adequate when he or she receives only a limited number of messages. However, in many cases, they are almost no use because the user may be notified very often of unimportant messages. The `biff` command displays headers and the first few lines of messages, but is highly interruptive because the user has to read the lines.

In contrast, users sometimes desire to find newly arrived e-mail messages as fast as possible. For example, some senders expect quick replies. Also, users may benefit from quickly grasping information, such as invitations for limited-time offers. However, it is too exhausting for users to read all messages.

We propose an application, Richbiff, that peripherally displays information about e-mail messages in attractive forms with a limited but sufficient amount of information for users to judge whether they should read them or not.

2 Approach

We adopted four features to fulfill the requirements for a notification tool.

2.1 Use of Kinetic Typography

Because e-mail messages consist of textual information, displaying text itself is straightforward. However, the user may easily miss new text when the display is full

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of text. Notification tools should actively attract the user's attention. We thus adopted kinetic typography [1]. Kinetic typography can be noticed even if it is displayed in the peripheral visual field, though it is less legible. It is also useful to represent attributes of information with motion patterns, which can help the user to estimate its significance or urgency, and to judge whether it is worth reading carefully [2]. In addition, it is aesthetically pleasing and enjoyable. This feature is suitable for ambient displays that peripherally present various kinds of information.

2.2 Adequate Amount of Information

Notification tools should provide an adequate amount of clues to support instant decisions on whether to read a message. A trade-off exists between the number of clues and understandability; too many clues take more time for the user to read, while too few are insufficient for decision-making.

The sender, recipients, subject, message body and attachment files are constituent elements of an e-mail message. Richbiff displays the sender, the subject, and keywords in the message body because they are considered to be essential parts.

2.3 Control of Notification Levels

The probability of an e-mail message being read can be estimated with some degree of accuracy. Richbiff estimates it from reading histories and determines a motion pattern according to an estimated possibility, i.e., vigorous motion if it is likely to be read and quieter motion if it is not likely to be read.

2.4 Information Censoring

If notification is performed in a public space, filtering functions are required for privacy. We assume that concerned persons still can understand partially corrupted or incomplete information because they can complement it with their knowledge. For example, people who are proficient in English can understand the scrambled sentence shown in Fig. 1[1], though it may be difficult for beginners to understand. Similarly, we expect that concealment of some characters in words makes it difficult for outsiders to understand. This method also helps prevent embarrassing words from excessive exposure in a public space.

> Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

Fig. 1. An example of scrambled text. The order of letters except the first and the last one in each word are randomly shuffled.

[1] The source is unknown. Matt Davis reported a discussion on the description in his Web page http://www.mrc-cbu.cam.ac.uk/~mattd/Cmabrigde/, which is currently inaccessible. It can be found at some Internet archive sites, such as Wayback Machines and Google's cache (retrieved on Feb. 1, 2009).

3 Implementation

Fig. 2 shows the architecture of Richbiff. The mail user agent communicates with a mail server and checks new e-mail messages. The text processing module applies morphological analysis to messages to extract words and determine their parts of speech. The keyword extraction module calculates tf/idf values of the words in the messages and selects significant words. The reading-possibility estimation module infers whether the user will read a new message using a Bayesian filter that is trained with senders, words in subjects and message bodies, and reading histories.

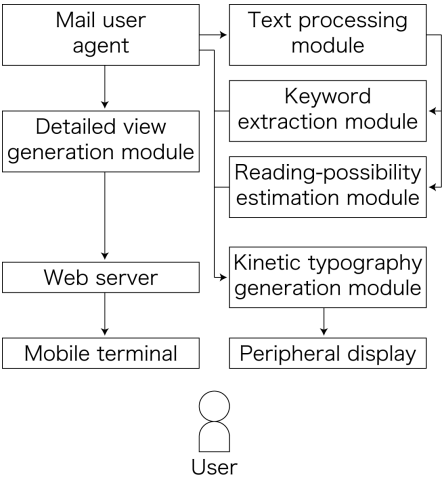

Fig. 2. Architecture of Richbiff

The kinetic typography generation module composes moving texts for each e-mail message showing the sender, the subject, and keywords by applying them to an animation template [3]. It displays e-mail addresses without the real names of the senders to conceal private information from other people. It divides the subject into segments and displays them with a scrolling motion from the bottom to the top of the screen. The keywords are displayed with zooming pop-up motion; final scaling factors are

Fig. 3. Screenshot of Richbiff. The sender's address at the left top is hidden to protect personal information.

determined according to their tf/idf values. It displays messages with high reading probability in active motion. Letters in each word are randomly replaced with symbols (the current implementation uses asterisks, "*") according to a preset censoring rate. Fig. 3 shows a screenshot of Richbiff. Fig.4 shows an example sequence of scrolling and pop-up motion.

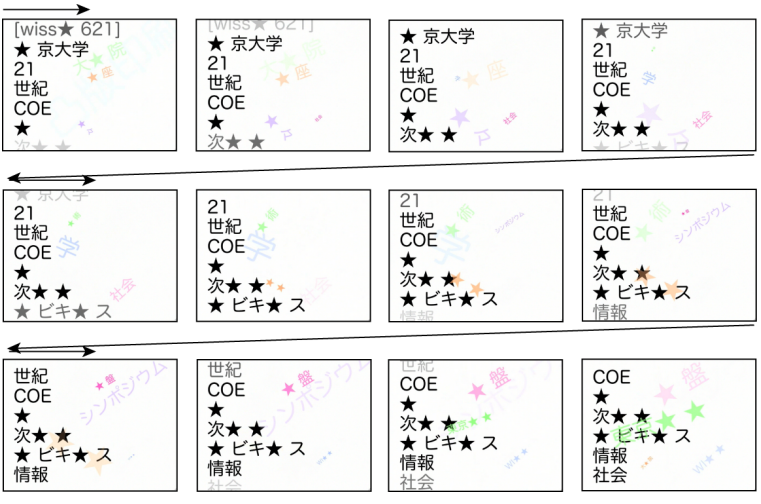

Fig. 4. Example sequence of scrolling and pop-up motion (five fps)

Richbiff plays the generated animation of text using a customized version of the kinetic typography engine [1]. At the same time, it generates detailed views of the messages on a local Web server. The user can read the entire content of the current message with a Web browser on a mobile terminal (Fig. 5).

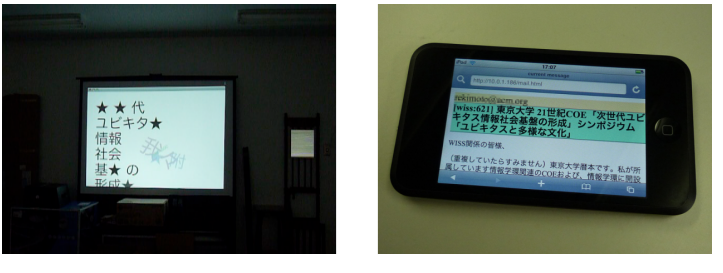

Fig. 5. Actual operation example. The picture on the left shows a peripheral display of Richbiff. On the right is a Web browser showing a current e-mail message reported by the peripheral display.

4 Discussion

We have qualitatively confirmed the following effects through trial use of Richbiff, though we have not quantitatively evaluated them.

4.1 Effects of Kinetic Typography

Kinetic typography was able to strongly attract the user's attention.

We have not compared the degree to which it interrupts users' work with that of other notification media, for example, sound and static texts. According to our subjective views and audience comments at demonstrations, kinetic typography interrupted the user at the same level as, or a little bit more weakly, than an alarm sound. However, it could provide enough information to show digests of e-mail messages. In contrast, audio requires a certain period of time to provide such digests.

The user could notice its motion even if it was displayed in the user's peripheral visual field because its brightness varied. This achieved an effect similar to that of ambient displays, which convey information to the user with abstract changes, such as lighting patterns. Kinetic typography was superior in notification to static text, which the user could easily miss when it was displayed in his or her peripheral visual field.

Continuous display of kinetic typography sometimes caused environmental disorder, that is, it conveyed visual restlessness. However, it will be acceptable to the user that the system uses vigorous motion only for messages likely to be read. In addition, the user may become accustomed to the restlessness with long-term use.

4.2 Adequacy of Amount of Information

The amount of information provided by Richbiff was adequate for understanding outlines of e-mail messages in a short time. Some newly arriving e-mail messages of high importance and/or urgency are related to the user's ongoing tasks or discussion. Thus, outlines were enough to trigger the user to check such significant messages, of which the contents were predictable with a few clues.

We inspected the effects of information about the sender, the subject, and keywords by comparing displays with and without them:

Displaying the sender was useful for judging whether the message was worth reading immediately, though it did not contribute as much to the understandability of outlines. For example, users paid great attention to e-mail messages from their friends and colleagues and often neglected e-mail newsletters. The current implementation displays only bodies of e-mail addresses without the senders' real names. This is enough for recipients to understand who the sender is. The user was sometimes anxious that strangers might figure out at least the sender's affiliation when it was displayed in a public space. Abbreviation of domain parts, for example `mmina@CKAJ` instead of `mmina@cse.kyoto-su.ac.jp`, will be effective in such a case.

Subjects provided essential information, because it was difficult to guess contents of messages in many cases when they were hidden. However, they sometimes required too much user's attention to read them.

Keywords helped users to understand outlines of e-mail messages of which the subjects were inadequate or vague. The pop-up display pattern was able to give impressions of messages without requiring active reading. Simultaneous use of popped-up keywords and scrolling subjects was not confusing because they were displayed in different areas and orientations.

4.3 Effects of Control of Notification Levels

It was effective to select display patterns according to notification levels, i.e., the system displayed messages of high reading probability with active motion. As discussed in section 4.1, kinetic typography with great variation in visual expression tends to attract the user's attention too much. This mechanism of notification level control reduced such unnecessary intrusion on users' on-going tasks.

We have not quantitatively evaluated the accuracy, precision, and recall. According to our subjective view, it was nearly as useful as spam filters, which use the same technique of Bayesian filtering.

4.4 Effects of Information Censoring

It was possible to understand content with certain degrees of concealment of letters. Fig. 6 shows examples of displays at various censor rates.

Our empirical observation suggested that most messages at low censor rates (under 0.25) were understandable with little difficulty, and that those at high censor rates (over 0.5) were difficult to understand even if the messages were highly relevant to the user. Mid range censor rates (between 0.25 and 0.5) could make messages moderately obscure: the user could understand such messages if he or she knew the topic but could only vaguely understand them if he or she had no context for them. According to these observations, we expect that the effect is applicable to outsiders who do not

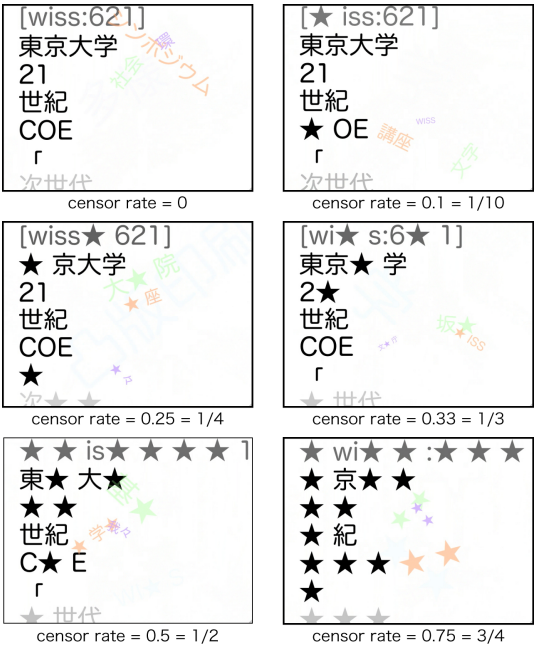

Fig. 6. Examples of display at various censor rates

share the recipient's background, though we have not fully confirmed this. Quantitative evaluations, including differences in understandability for concerned persons and others would be priority in our future work.

We implemented the random concealment algorithm that randomly replaces letters in words. However, it sometimes caused spotty concealment when the censor rate was in the middle range. It is not preferable because important words may be concealed too well to understand, and sensitive information may be inadequately concealed. It would be useful to conceal at least one letter in a word. A black-list of words would also be useful to mandatorily censor specific words.

4.5 Other Discussion

- Animated display had sometimes progressed only part of the way when the user noticed it. In these cases, the user may not guess the content of messages because of missing an important part. Thus, we implemented rewind and fast-forward functions for both the peripheral display and the Web page, which enabled the user to navigate to the previous and next messages. We used a keypad for the peripheral display, but it was not suitable for some situations, for example, when the user did not have the keypad at hand. Other multimodal operations, such as voice and gesture, would be useful.
- Richbiff might also be useful for reminding the user about e-mail messages he or she has not read or forgot to reply to. We are planning to improve it to report such missed e-mail messages. However, handling all received messages is not effective. We should introduce inference techniques of significance to report only possibly important messages.
- Although we designed Richbiff for a single person's use, it can be extended to multi-user environments. This could make good use of peripheral displays in shared places, such as small offices and living rooms. In that case, Richbiff needs to display messages in such a way that users can distinguish their messages from others. For example, it can change the background color, the display position of each element, or the animation pattern according to the recipient.

5 Related Work

According to a taxonomy of ambient information systems by Pousman and Stasko [4], a few existing studies were classified into medium or somewhat high levels of information capacity and notification level, the levels for which Richbiff aimed. We considered that one reason is a lack of a proper display form. Also, this kind of notification tool was excluded from a definition of ambient information systems. In addition, they defined high-throughput textual displays that have low aesthetic emphasis. However, Richbiff achieved aesthetic representation of richer information. Hence, kinetic typography can make a new kind of ambient display that has medium information capacity, medium notification level, high representational fidelity, and high aesthetic emphasis.

Vogel and Balakrishnan proposed interactive public ambient displays that supported the transition from implicit to explicit interaction with both public and personal

information [5]. They represent messages in an abstract form of color bars when the user is far from the display. When the user approaches the display, it shows content of messages with small letters in order to prevent others from reading it. Though this approach is a useful way to handle personal information in a public space, it requires sensors to detect the distance between the user and the display. Moreover, the color bars may be too abstract to trigger implicit interaction.

Many automatic text summarization techniques have been proposed. They can improve Richbiff by allowing it to show better summaries of e-mail messages to reduce the need to access the entire content with a Web browser.

As for information concealment, Nakamura and Tanaka proposed an information-filtering system that detects and hides entities, for example, results of sport games, referring to the user's recording schedule of TV programs [6]. This approach, that is, targeting parts of information by referring to external information, is useful for hiding appropriate parts of e-mail messages.

6 Conclusion

We developed an email notification application named Richbiff that peripherally displays information about e-mail messages. Richbiff has the following four features: use of kinetic typography, providing an adequate amount of information, control of notification levels, and information censoring. Our trial use proved their effectiveness. Kinetic typography could strongly attract the user's attention and could realize aesthetically appealing and enjoyable peripheral textual displays. The amount of information that Richbiff provided was adequate to motivate the user to check the full text of significant e-mail messages. The motion pattern selection was useful to reduce unnecessary intrusion on user's on-going tasks. Empirical observation suggested that the concealment of letters with the proper range of randomness worked well.

In future work, we plan to quantitatively evaluate the effects, including noticeability and intrusiveness of kinetic typography and understandability of partially hidden words.

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