Dying Link

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Abstract

We propose a new visualization technique called the *Dying Link*, which makes the links to Web pages look aged according to how old the linked pages are. Using our technique, users can easily tell how "fresh" the linked pages are, only by glancing at the appearance of the link string in a Web page. We describe the design, implementation, and evaluation of the Dying Link system.

1   Introduction

Although a number of attractive graphical Web pages exist on the Internet, we can find many outdated pages, maybe because it is difficult for people to keep those pages always up-to-date. One of the authors once made fancy Web pages with many graphical objects, but he had no chance to update them for three years, since they were too complicated for modification.

Although there exist many old Web pages, we cannot easily recognize how old they are, since their appearances do not change by their ages. In contrast, many real-world objects change their appearances as they get older, and we can vaguely see how old they are simply by glancing at them. For example, we can recognize how old a book is, from the color and shape of the book.

We propose a new visualization technique called the *Dying Link*, which makes the links to Web pages look aged according to how old the linked pages are, just like real-world objects. Using our technique, users can easily tell how "fresh" a Web page is, only by glancing at the appearance of the link string in a Web page.

2   Dying Link

Dying Link is a technique to display the "freshness" of Web pages pointed by hyperlinks in a Web page. When a user browses a Web page using the Dying Link system, the link to an old page is displayed in a blurred text or a vague figure, and he or she can easily see how old the target page is. Just like a user can tell visited Web pages from unvisited Web pages on standard Web browsers, he or she can tell how old the destination pages are, only by seeing how blurred the links to the pages are. Figure 1 illustrates how Dying Link can visualize the freshness of the linked pages.
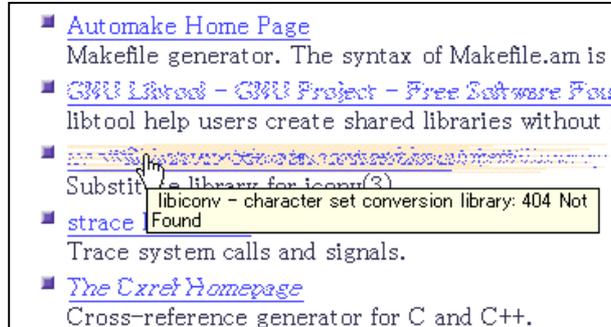
Figure 1: The visualization of Dying Link.

Since various font faces and colors are used in Web pages, it is difficult to visualize the freshness of the links only by changing those attributes of link strings. In contrast, almost all the texts and images in Web pages are designed to be displayed clearly, and blurred texts almost never appear in Web pages. For this reason, using blur is ideal for representing the freshness of link strings. According to Byrne et al. (Barrett, Maglio, & Kellem, 1997), the *locate* task to find desired information or links on a page is the second most time-consuming activity among WWW user tasks and they also argued that using different colors for visited Web pages helps users locate information. In the same way, Dying Link can help users locate fresh information efficiently.

3   Implementation

The Dying Link system is implemented as a Web proxy server. When it receives a request to display a Web page, it checks the modification time of the Web pages linked from the page, and simply adds special *dying tags* to the links according to the age of the linked pages. The dying tags use Cascading Style Sheets (CSS) to express the dying effects. For example, the following style sheet defines extreme effect for dead links and the effect can be applied by specifying "dead" to the *class* attribute in the HTML elements.

```
<style type ="text/css">
<!--  .dead
{ filter:wave(freq=5, lightstrength=0, phase=30, strength=50, add=false); }
 -->
</style>
...
<img class="dead" src="image.jpg">
```

Figure 2: Example of CSS to express the dying effects.

Since the ages of many linked pages should be checked before a Web page is displayed, all the operations are performed in parallel. If the system cannot determine how old the linked page is in less than eight seconds, the system will give up adding the effect to the link, since users usually cannot wait for more than eight seconds to view a Web page (Nielsen, 2000).

We developed three variations of Dying Link effects, namely *Distortion*, *Fade*, and *Blur*. Users can cycle these effects by hitting the "reload" button of standard Web browsers. Figure 3 shows the examples of the effects.

Original page

With Distortion effect

With Fade effect
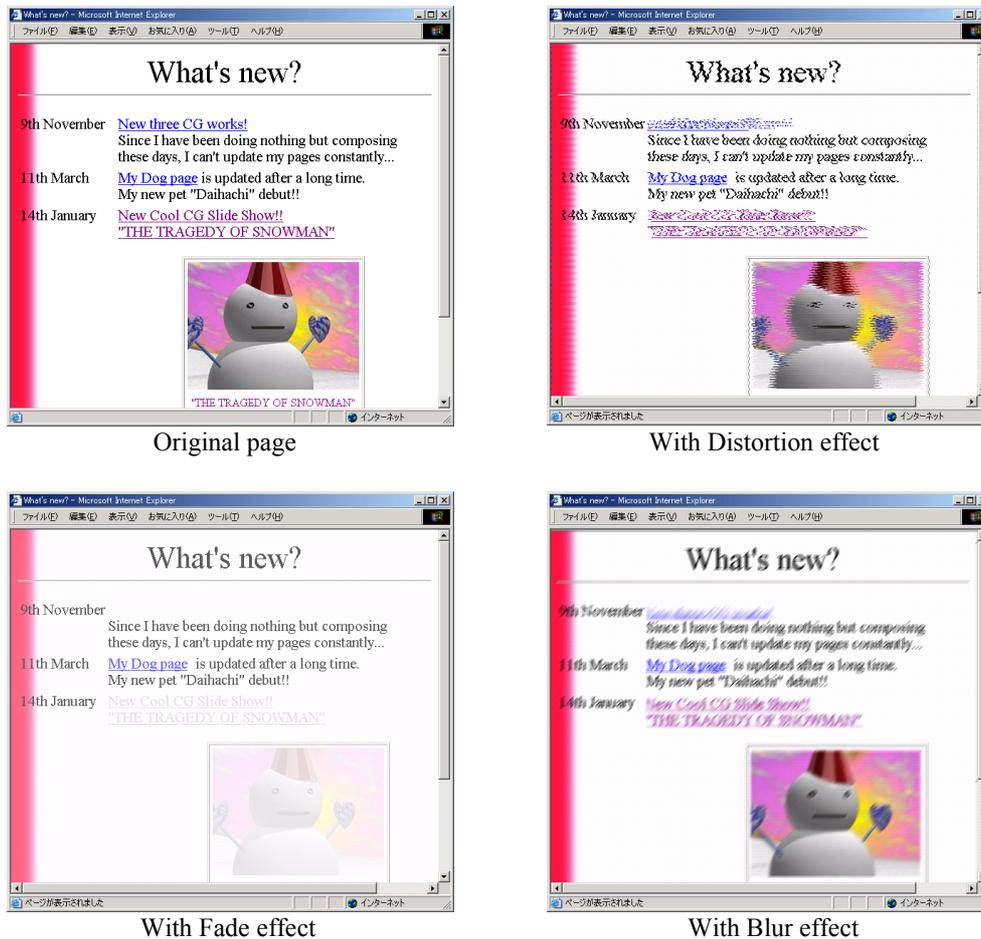
With Blur effect

Figure 3: Examples of Distortion, Fade, and Blur effects.

4   Discussions

Dying Link has been used by the authors for several months. Although a formal evaluation is not yet performed, we have found that Dying Link is especially useful in the following cases:

- Finding dead pages
  According to Nielsen (Nielsen, 1998), 6% of the links from Web pages are "dead links" in average and 60% of users get frustrated about the dead links. Using the Dying Link system, users can easily recognize dead links, and they do not have to visit those pages.

- Finding active people
  Some people in our laboratory update their Web pages frequently, and others do not. We can easily recognize the differences only by seeing the member list of our laboratory on the Web.

- Making people update their pages more frequently
  Using the Dying Link system, users can very easily tell old pages from new pages. This fact can remind the Web page authors of how old their pages are, and make them feel like updating their pages more often than without using the Dying Link system.

Links to some Web pages are vaguely displayed even when they are actually very important, if they have not been modified for a long time. This is because current implementation of the Dying Link system determines the appearance of a link only from the modification time of the linked Web pages. Maybe it should determine the appearance also from how often the Web page is accessed, which may represent how important the Web page is.

At this moment, our system only works with the Internet Explorer, because of the restrictions of CSS. Also, it takes several seconds before displaying a Web page with hundreds of links. We are trying to eliminate these restrictions.

5 Related Works

Traffic Lights (Barrett, Maglio, & Kellem, 1997) (Maglio, & Barrett, 2000) annotates each link with simple colored icons around each hyperlink to indicate the speed of the network to those particular servers. While Traffic Lights focuses on the traffic speed of the network, Dying Link mainly focuses on the freshness of linked pages. Moreover, our approach is more intuitive because Dying Link uses aging effects instead of simple icons.

Visual Previews (Kopetzky, & Muhlhauser, 1999) shows visual thumbnails of linked pages. When the mouse pointer moved over a hyperlink, the preview window is opened by JavaScript. Unlike Visual Previews, Dying Link does not require users to move the mouse pointer to tell the freshness because our system adds visual effects to all hyperlinks directly.

Fluid Links (Zellweger, Chang, & Mackinlay, 1998) is a system for showing extra information attached to the displayed text string, when a user moves the mouse pointer over the text. The extra information should be prepared by the author, and users should move the mouse pointer over the string when they want to see that information. Although Dying Link only displays the freshness of the linked pages, the information is displayed without requiring special preparations.

Time-Machine Computing (Rekimoto, 1999) has a visualization technique using the modification time information. For example PostIt notes on the desktop gradually fade according to its modification time. While the main focus of Time-Machine Computing is personal desktop environment, our approach is optimized for efficient Web navigation.

Live Web Stationery (Seligmann, & Bugaj, 1997) employs a visualization technique similar to our system. It visualizes a Web page as if it were an old piece of paper. However, since the visual effect is generated as a background image, Live Web Stationery is difficult to be applied to pages with complex layouts, while Dying Link can be applied to arbitrary Web pages.

There are researches on the visualization of the users on WWW (Jung, & Lee, 2000) (Minar,

1999). We are planning to employ those techniques to reflect the popularity of Web pages to the link visualization in the future.

6   Conclusion

We proposed a new visualization technique called the Dying Link, which makes the links to Web pages look aged according to how old the pages are, just like real-world objects. We observed that our system can help users easily recognize the freshness of information pointed by hyperlinks, and it can urge people to think about updating their Web pages more frequently.

References

Barrett, R., Maglio, P. P., & Kellem, D. C. (1997). How to personalize the Web. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI '97)*, 75-82. Addison-Wesley.

Byrne, M. D., John, B. E., Wehrle, N. S., & Crow, D. C. (1999). The tangled Web we wove: A taskonomy of WWW use. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI '99)*, 544-551. Addison-Wesley.

Jung, Y., & Lee, A. (2000). Design of a social interaction environment for electronic marketplaces. In *Proceedings of Designing Interactive Systems (DIS '2000)*, 129-136.

Kopetzky, T., & Muhlhauser, M. (1999). Visual preview for link traversal on the WWW. In *Proceedings of the Eighth International World Wide Web Conference*, 447-454.

Maglio, P. P., & Barrett, R. (2000). Intermediaries personalize information streams. *Communications of the ACM*, 43(8), 96-101.

Minar, N. (1999). Visualizing the crowds at a Web site. In *CHI '99 Extended Abstracts*, 186-187.

Nielsen, J. (1998). Fighting Linkrot. Retrieved February 14, 2003, from http://www.useit.com/alertbox/980614.html

Nielsen, J. (2000). Designing Web Usability. New Riders Publishing.

Rekimoto, J. (1999). Time-machine computing: A time-centric approach for the information environment. In *Proceedings of the ACM Symposium on User Interface Software and Technology*, 45-54.

Seligmann, D., & Bugaj, S. (1997). Live Web stationery: virtual paper aging. In *Visual Proceedings: The art and interdisciplinary programs of SIGGRAPH '97*, 158.

Zellweger, P., Chang, B. & Mackinlay, J. D. (1998). Fluid links for informed and incremental link transitions. In *Proceedings of the ACM conference on Hypertext and Hypermedia'98*, 50-57.