The Birdlime Icon: Improving Target Acquisition by Dynamically Stretching Target Shape

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ABSTRACT
We propose the Birdlime icon to facilitate pointing tasks by stretching target shape dynamically in the cursor direction as it catches the overshooting cursor. The Birdlime icon can provide visual target "stickiness" and facilitate pointing with few side-effects compared the other techniques, especially when the cursor must move through distracters to reach the user's intended target.

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General terms: Design, Human Factors

Keywords: Pointing, GUI, multiple targets.

INTRODUCTION

Research about pointing in GUI interfaces has revealed that more than half of the load of pointing movements is induced in the latter half of the movement [8], and target size greatly affects the latter half of pointing [4]. Based on these studies, increasing target size has been used to facilitate pointing movements, especially in the latter half of the movement.

Expanding target techniques have less side-effects and maintain performance even when many distracters are in the movement path, because they allow users to freely move the cursor without any change of the cursor velocity in presence of distracters.

We believe that target icons should be more intelligent and have greater tolerance for approaching cursors through the leveraging of target expansion. Consequently, we propose the Birdlime icon, in which the target size and shape change dynamically as the target catches the overshooting cursor. This behavior is designed to give the users a feeling of stickiness. We believe this technique will support natural pointing movements with less kinematic load.

RELATED WORK

A method that decreases target distance [1] can reduce pointing time considerably, but it risks unintended jumps or errors in multiple target situations. In this paper, we focus on seeking a technique with minimal side-effects that can provide reasonable time reduction and fewer errors by increasing target size.

Three main approaches exist to increase target size: expanding the target size in both visual and motor space, increasing the target size in motor space by decreasing the cursor velocity, and increasing the effective target size by expanding the cursor's active area.

Many researchers have investigated the first approach [3, 6]. Although effects of target expansion timing and size have been thoroughly studied, alternative expansion geometries have not been well investigated. An expansion method that is more tolerant to cursor overshooting should be investigated since users often perform overshooting [8].

The techniques that employ the second approach have tolerance for approaching cursors by producing target stickiness [7, 9]. However, they fail to provide increased performance in multiple target situations because unintended stickiness by distracters result in overly constrained pointing movements.

The third approach is the well-known area cursor [9]. Enhanced area cursor techniques such as Bubble cursor [5] and DynaSpot [2] were also proposed. However, these techniques constantly change the size of the cursor, which can be distracting.

BIRDLIME ICON TECHNIQUE

Overview

We designed a novel target expansion technique called "Birdlime icon" that stretches the target shape as it catches the overshooting cursor, in order to make icons more tolerant to approaching cursors. This stretching occurs dynamically and smoothly so that users can feel the stickiness. In addition, this stretching is performed after the cursor enters the target so that it does not prevent from selecting empty space close to the icon.

This simple technique offers a wider area for clicking, and reduces the chance of overshooting. For a single target, this can reduce pointing time in a manner similar to sticky icons [7, 9]. Moreover, unlike these other techniques, we hypothesize its effectiveness will not drop even when the cursor must go through distracters to reach the target because it does not change cursor velocity.

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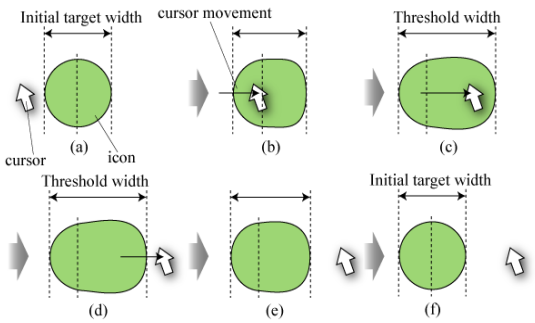

Fig. 1 Appearance of Birdlime icon

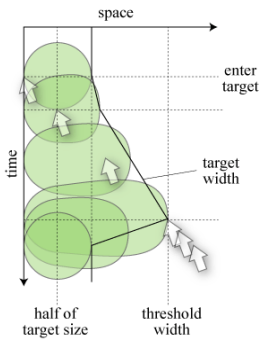

Fig. 2 Timeline of Birdlime icon expansion

Design and Implementation

The icon shape does not change when the cursor is outside the icon (Fig. 1(a)). When the cursor enters the icon, the icon smoothly stretches toward the cursor movement (Fig. 1(b)) and stretches more as it catches the overshooting cursor (Fig. 1(c)).The length of icon stretching has a certain threshold over which the icon does not stretch (Fig. 1(d)). When the cursor leaves the icon or stops for a certain time on it, the icon automatically shrinks to its initial shape with elastic animation (Figs. 1(e) and (f)).

A timeline of the Birdlime icon is shown in Fig. 2. For the expansion to be effective, it must start while the cursor is on the icon and before the cursor reaches the border of the icon and exits from it. The icon stretches smoothly with cursor movement, and the stretching velocity is slow until the cursor reaches the center of the target, and it increases after the cursor passes the center of the target. When the length of stretching reaches the threshold width, the icon stops stretching. Then its width smoothly shrinks to the initial shape after the cursor leaves the icon.

Advantage

In our pilot study of 12 users, most participants could feel stickiness with the Birdlime icon even though it does not change the cursor velocity. We assume that the Birdlime icon can provide a better feeling of slowing the cursor with less visual load than the other target expansion techniques.

We expect that some of the other techniques that we described in related work may outperform the Birdlime icon in target acquisition tasks in simple scenarios. Nevertheless, we hypothesize that the Birdlime icon will be beneficial in more cluttered realistic scenarios because it does not prevent the user from selecting empty space and its performance may not be affected by distracters in recent complex GUIs.

Therefore, in the future work, we will conduct comparison experiments with the other techniques in practical situations. For example, we will investigate situations where there are many targets, and empty space close to the target must be utilized. We hypothesize that the Birdlime icon will outperform the other techniques in these situations.

CONCLUSION

In this paper, we proposed the Birdlime icon technique in which target shape is stretched dynamically and smoothly in the cursor direction as it catches overshooting cursors. The Birdlime icon is expected to outperform the other techniques in practical situations such as when the cursor must move across distracters to reach the user's intended target. In future work, we will explore the difference with the other techniques and improve the implementation to tolerate even more complicated situations such as targets next to each other.

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