Cursor Considerations for Pointer-Based Systems

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Version History

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V1.0	03/17/2015	Original Version
V1.1	08/24/2016	Updated Format

Contents

1.0 Introduction

Designing the cursor for a pointing-based TV must consider factors that differ from the implementation of a cursor for a computer screen. Several factors affect cursor design. First, the general use-case must be considered, up-close interaction vs. the lean-back interaction that occurs when a user is across the room. Then, the context in which the cursor is displayed as well as the remote control device being used to control the cursor must be considered since each of these factors will greatly affect the design decisions required to maximize user satisfaction.

This document provides an overview of these design factors and recommends specific approaches to cursor implementation that could be made to address them. Since this document focuses on cursor design alone it will only lightly review systemic implementation factors that can also affect cursor performance such as use of a bounded cursor, addition of tremor cancellation, and implementation of button motion suppression.

2.0 Cursor Graphics

Graphically, a cursor must stand out from the scene on which it is displayed. Design effort must be made to (1) ensure that the user can always see where the cursor is located (i.e. not "lose" the cursor) and to (2) ensure that the user has a strong sense of control over the cursor. Finally, the user must also have a clear understanding of what the cursor represents; in other words, the user must understand that the cursor is designed to make selections using the cursor's "hot spot" (selection zone) and the user must also understand how to use the cursor to initiate an action.

2.1 Cursor Size and Weight

TV and computer use cases are different. When using a computer, the user sits next to the screen and is heavily focused on it; with a TV, the user sits far away and takes a more casual interest in screen details. On a computer screen the cursor doesn't require much weight to be seen. But on a TV the cursor must have significant graphical weight so that it can be viewed easily from a distance. The thin arrow-style cursors often used on PCs are easily lost visually when viewed from a distance.

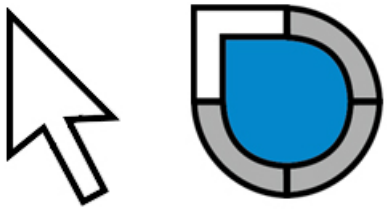

Figure 1 - Comparison of PC Cursor to TV Cursor

Several system design elements affect the perceived size of the cursor. Resolution, physical screen size, and viewing distance are three different but inter-related variables that affect cursor visibility. The cursor must scale to accommodate these three variables. As an example, if the resolution is changed from 720p HD to 1080p HD, the cursor would need to scale up its size in pixels by approximately 50% in order to remain the same physical size to the user. Similarly, if a 50 inch TV displays the cursor as 3 inches wide to the user, then a 65 inch TV would show the same cursor at more than 3.9 inches wide. The user's physical distance from the screen also changes apparent size; the farther away the user is from the screen, the smaller the perceived size.

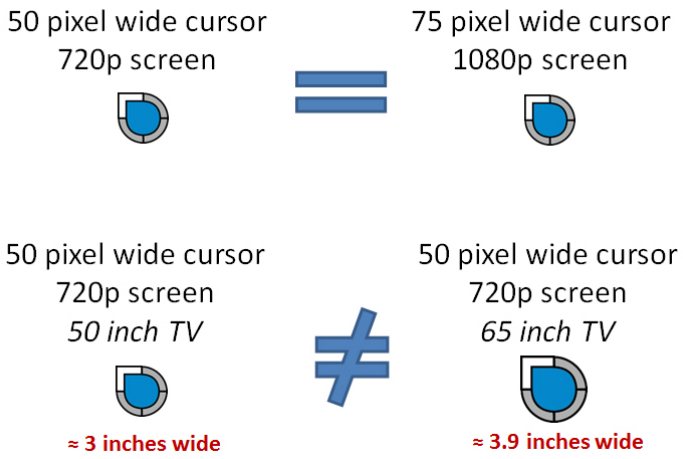

Figure 2 - Cursor Size and Scale Comparisons

Although the TV system is aware of cursor resolution and screen size and the system and software can make dynamic adjustments for those factors to maintain an ideal cursor image, a cursor size setting should also be provided so the user can adjust the cursor to accommodate viewing distance and individual visual acuity.

2.2 Need for Contrasting Colors

A significant difference between a computer screen and TV screen is the background over which the cursor is active. Computer screens are generally static and do not vary significantly in color range at a given time (most applications use solid color backgrounds). The TV is different; in most cases the TV screen is an active picture with a great deal of dynamic imagery that draws the eye to different parts of the screen. Additionally, these dynamic screens can change the background color abruptly, quickly and often, especially when the cursor is in motion, which can also reduce visibility of the cursor.

To address this, the cursor graphics should be composed of at least two contrasting colors so that the cursor stands out visually over a broader range of background colors. If a two-color design is used, then when the video background color changes, a contrast will exist in the cursor color leading to improved visibility. There is a small side effect from this approach, however; it can make the cursor appear to "pulse" or "breathe" as the contrast changes. And, since this effect is caused by the background changing, it is outside of the control of the cursor design process. To illustrate this point, if the cursor has a black outline then it is easily visible when it is over a light color, but, if the color then shifts to a black or other dark color, the outline may seem to disappear as it blends in with the background. The result is that the cursor may appear to get slightly smaller to the user. While this side effect can sometimes be seen, it is still preferable to the alternative -- having the user lose sight of the cursor altogether.

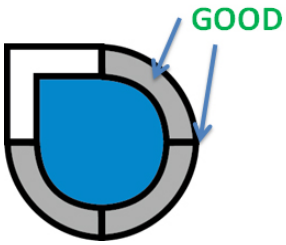

Figure 3 - Use of Contrasting Colors

2.3 Hot Spot Location Must Be Obvious

Lastly, the graphic design must directly inform the user of the portion of the cursor that actually marks the selection "hot spot." This should be well-defined by the shape of the cursor. It isn't good design to use the entire cursor image as a selection area for two reasons; first, due to the required graphical weight of the cursor, it would unnecessarily force the application designer to use over-sized targets as well as spacing and; second, a large portion of the cursor would obscure the selection target. It is, therefore, a better graphic design to use a portion of the cursor along one point or edge as the "hot spot" and have the graphics clearly define the selection point.

In the past, because text is read from the upper left to the lower right, the cursor generally points to the left and the hot spot is set to the upper left of the arrow so the cursor body is less likely to block critical parts of the current selection area in text, such as web hyperlinks. This motivator is less important on a TV visual display, but this common design paradigm still has some value by limiting the obstruction of text on buttons. In this regard, it is reasonable that this aspect of the design mimics the cursor design methodology of the PC.

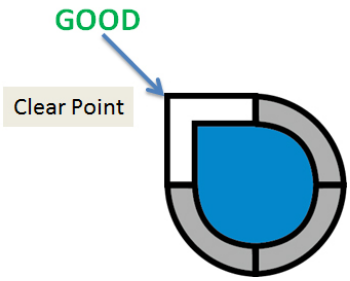

Figure 4 - Obvious Selection "Hot Spot" in Upper Left

2.4 Highlight State

These same graphic considerations must be considered when designing the highlight state for the cursor; the highlight must be easily visible from a distance so the highlight change must have graphic weight; the highlight graphic should be dynamic enough to draw attention and have enough contrast against the non-highlighted cursor color design to insure effective detection. Finally, it should reinforce the selection area.

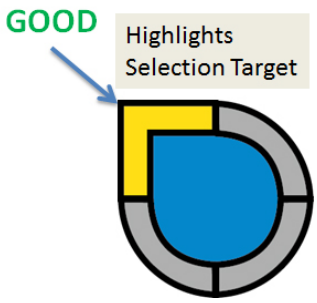

Figure 5 - Highlight Cursor State

3.0 Other Related Design Factors

Additional functional elements should be part of the system design but they have fewer, if any, cursor graphic considerations connected to them. For completeness they are listed here and comments related to graphic design are added where appropriate (*italicized for emphasis*):

3.1 Tremor Cancellation

This removes the impact of human tremor on the remote control sensors and thus the "shaking" of the cursor that is often visible on absolute system such as a laser pointer or the Nintendo Wii. To further reinforce this stability, the cursor graphic should use *anti-aliased transparency along its edges* as this will reduce edges that appear to sparkle when used over a dynamic background such as active video. The value of tremor cancellation is that it increases user control and therefore does not force the designer to oversize targets as is done on systems that lack this feature.

3.2 Button Motion Suppression

This feature causes the "dead-zone" of the device to get larger when the user pushes a button on the remote. Another way to say this is that the impact of small motions on the remote is ignored for some period of time after a button is pressed. When a user pushes a button, there is a natural tendency to move the remote due to the force of the finger against the device; by increasing the dead-zone during this action (pause motion detection), the cursor remains in its fixed position as the user expects. In general use, the dead-zone area should be as small as possible to give the user fine motion control over the interface. There is *no significant graphic constraint* associated with this feature, however, good button motion suppression design will not force the designer to increase target sizes to prevent the inadvertent deselecting of a target.

3.3 Bounded Cursor

While the cursor graphics are designed to maximize cursor visibility, they are not useful if the cursor can actually leave the screen and get lost. In a TV platform where the use of a relative pointing system reduces the energy required to control the cursor and, therefore, increases user satisfaction*, the cursor should be "bounded"*; the cursor does not ever leave the visible screen due to motion. The visible screen on TV is defined as 5% in from each side of the screen (the "safe frame") to accommodate overscan in TVs.

3.4 Cursor Hide/Show Control

The cursor needs to become visible when the user picks up the remote to make an action and must become invisible when the user does not want it on screen such as when he or she is sitting back to watch a show. The guidelines for cursor display control are not covered in this document but they are relevant to cursor design. If the cursor has a good default design it should be apparent to the user when it becomes visible on screen; however*, it is possible to have a third state in addition to regular and highlight which is "cursor becomes active"*. This is the transition state going from invisible and visible and could add some dynamic visual effects that draw the user's eye to the cursor when it first reappears.

4.0 Conclusion

This document provided a high level overview of factors that must be considered when designing a cursor for a pointer-based television. Since circumstances vary, specific recommendations would require an examination of specific designs and use-cases.

Since every system and implementation is unique, it is important that technical parameters be tested as part of a complete system test. It is also important to test design choices in realistic contexts; for example, the cursor design should be tested over a live TV picture and not just on static backgrounds.

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