The “Prince” Technique: Fitts’ Law and Selection Using Area Cursors

ABSTRACT

In most GUIs, selection is effected by placing the point of the mouse-driven cursor over the area of the object to be selected. Fitts' law is commonly used to model such target acquisition, with the term A representing the amplitude, or distance, of the *target* from the cursor, and W the width of the target area. As the W term gets smaller, the index of difficulty of the task increases. The extreme case of this is when the target is a point. In this paper, we show that selection in such cases can be facilitated if the cursor is an area, rather than a point. Furthermore, we show that when the target is a point and the width of the cursor is W, that Fitts' law still holds. An experiment is presented and the implications of the technique are discussed for both 2D and 3D interfaces.

KEYWORDS:

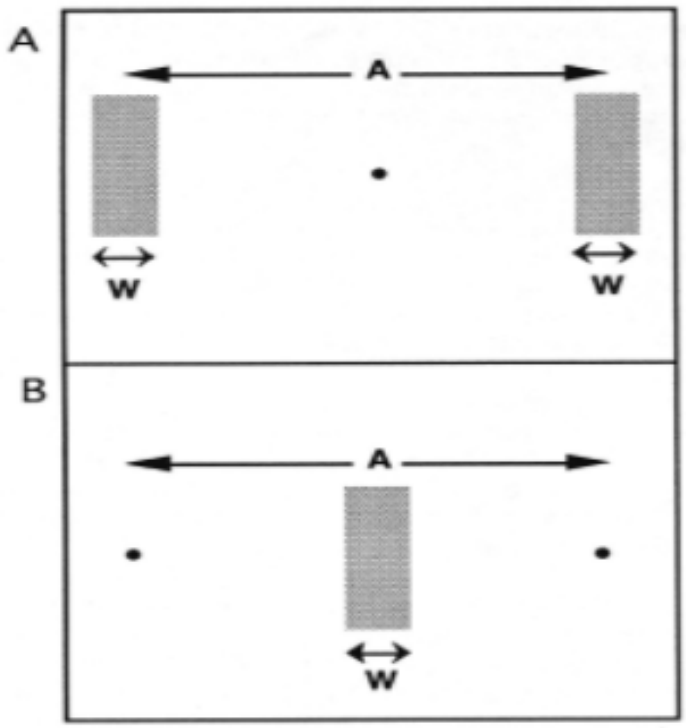
Input techniques, graphical user interfaces, Fitts' law, haptic input.

Twelve students from the University of Toronto participated as paid volunteers. All had experience using the mouse and were strongly right handed based on the Edinburgh Handedness Inventory [10].

A second capability of the area cursor is that it may function as a "net." Used in this way, an area cursor can group and select a collection of points or small objects with a single pointing movement, much as the "lasso" tool is used in drawing applications like MacDraw. This capability, however, also serves to illustrate a drawback with using the area cursor as the only selection tool in a GUI. This is that the Prince technique is inappropriate for fine positioning tasks, because selections may become ambiguous when displays are cluttered.

Our belief is that an effective way of exploiting the Prince technique is to combine it with the traditional point-cursor approach. Where fine positioning is not required, it may be possible to replace it by coarse positioning and the Prince technique. Furthermore, by dynamically switching

between Prince and point-cursor positioning techniques, the difficulty of positioning tasks can be matched more closely to task context.



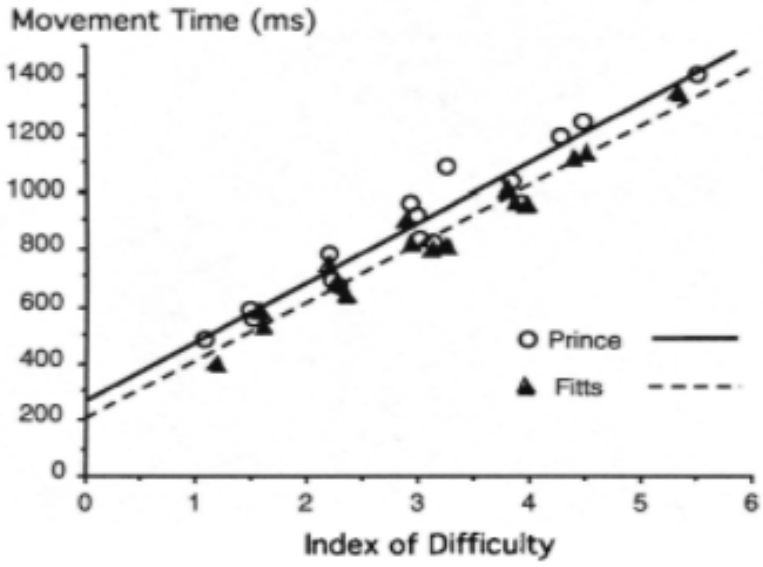


Figure 4: Scatter-plots of the *MT-ID* relationship in the Fitts and Prince techniques. The equation fitted was $MT = a + b\ ID$, where $ID = \log_2(A/W_e + 1)$. The reciprocal of the slope of each line gives the index of performance ($IP = 1/b$) for the technique.

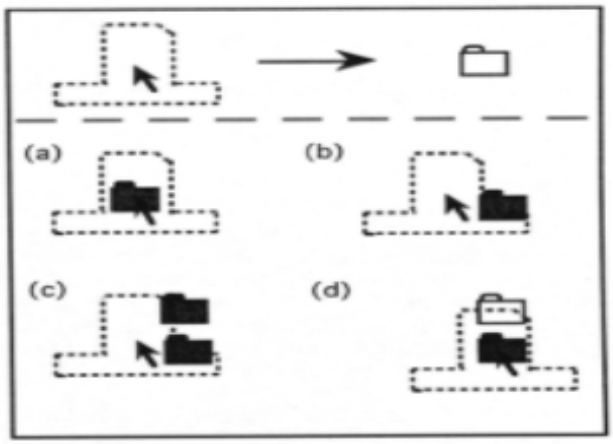


Figure 6: Moving a file into a folder. The user acquires a file and begins to drag its outline toward the folder. The folder will be highlighted to indicate selection. This occurs in (a) when the pointer moves inside the folder, and in (b) when the folder and the file overlap. In (c), the selection is ambiguous because the file overlaps with two folders. This can be resolved as in (d), by repositioning the pointer in one of the folders.

CONCLUSION

An alternative approach to pointing, called the Prince technique, was investigated and found to be comparable to traditional pointing methods. Because the Prince technique uses a cursor of large area or volume, it is suitable for tasks that are normally difficult with the standard pointer, such as acquiring small targets or points. We feel that the Prince technique may be especially valuable when used in conjunction with traditional pointing techniques, where it can be used to tailor task difficulty more closely to the accuracy demands of the task. The examples presented three distinct methods suggesting how this might be accomplished.

The current study is an initial probe into a rich design space. Many questions and issues remain. We investigated selection tasks involving one width parameter, either the target or the cursor. What happens when there are two width parameters, defined by moving and stationary objects? The whole issue of "grasping" isolated objects from among a close cluster requires much more investigation. Likewise, the 3D case of the volume cursor deserves study. It would also be worthwhile to compare and/or combine the technique with gravitational "snapping" techniques. Finally, for the full potential of the technique to be realized, it is likely that new affordances (such as supporting "grasping") need to be built into input devices, such as mice. This also requires further study.