

The Incrementor: A Graphical Technique for Manipulating Parameters

IT4

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Designer: Sanford Ressler**Purpose:** To visually organize a set of variables and to change the values of those variables.**Description:** The incrementor is a visually compact, flexible, and consistent mechanism for modifying the variables presented to the user. A locator (i.e., mouse) with two buttons is the required input device. The names of the variables appear in the center of one or two pairs of arrows, and the value of the variable appears just below the right arrow and to the left of the up arrow (Figures 1 and 2).**Device Semantics:** The button semantics are as follows: The left button is for selection and the right button is for help/information and menu selection. Actions are not continuous as in slider-type devices. Discrete actions occur on each selection click.

The current value of the variable is visible next to the arrows. Selecting points on the arrows causes the current value to be incremented or decremented by the increment amount. The arrows consist of four parts each. Each part will multiply the increment by a factor of 1, 10, 100, or 1000 as the distance from the center is increased. A pop-up menu (Figure 3), which appears when the right mouse button is pressed, visually and textually describes the actions. The menu items may also be selected, causing the indicated multiplier actions to occur simultaneously with the clicking on the big arrows.

Selecting the variable name or popping up a menu while over the name lets the user pick a variable to manipulate. The current value of all variables may be seen by popping up a menu (Figure 4) when on top of the variable name in the center of the arrows.

This technique differs from previous graphical numeric input devices in two main areas: First, it allows the user to control many variables in a visually compact area; second, it is intentionally discrete in its actions but still allows for rapid value changes. For example, one widely used technique, the graphical slider attached to a variable, is fine for small ranges of values, but, when the user requires fine control over a large range, the slider aliases values and the user loses precise numeric control.



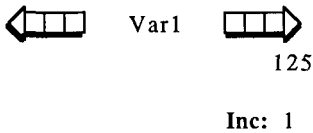


Figure 1

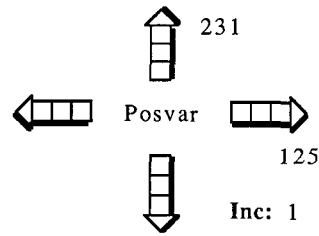


Figure 2

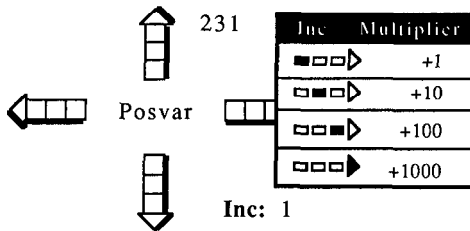
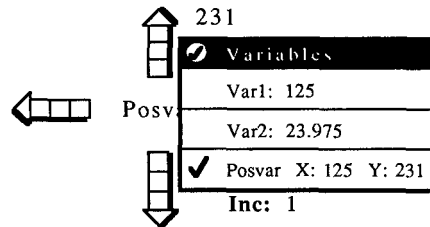


Figure 3

Figure 4



Applications: The appropriate applications for this input device have two criteria. If screen space is limited and the user must control many variables while having easy access to the values of those variables, the status menu will prove to be very useful by itself. If a wide range of values is possible, and the exact value is crucial, then this technique is again appropriate. The particular application for the original implementation was a graphical front end to a program called Tiletool [1], which generated tiling patterns (Figures 5 and 6). Some of the variables were controlled by using logical sliders. However, some of the variables required more numeric resolution than was available spatially in the slider. The slider aliased and skipped necessary values. Of course a vernier-type arrangement could have been implemented with several sliders of different resolutions or a single slider with changing resolutions, but the incrementor appears simpler and easier to use, and the discreteness of the actions is desirable.

The spatial or two-dimensional aspect of the incrementor is of value when the user desires to move an object a discrete amount in multiples of some increment. This effectively corresponds to positioning on a grid with varying resolution.

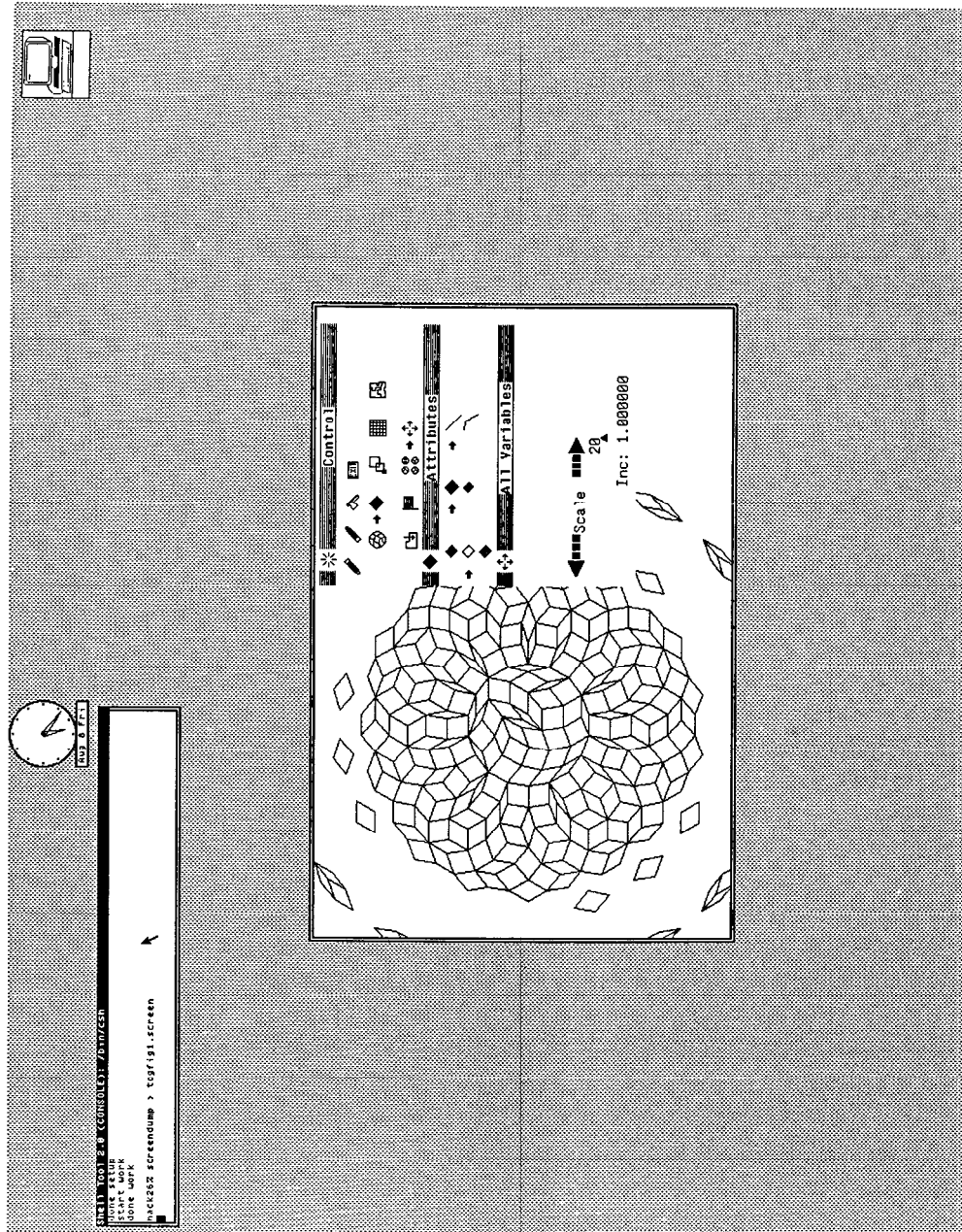
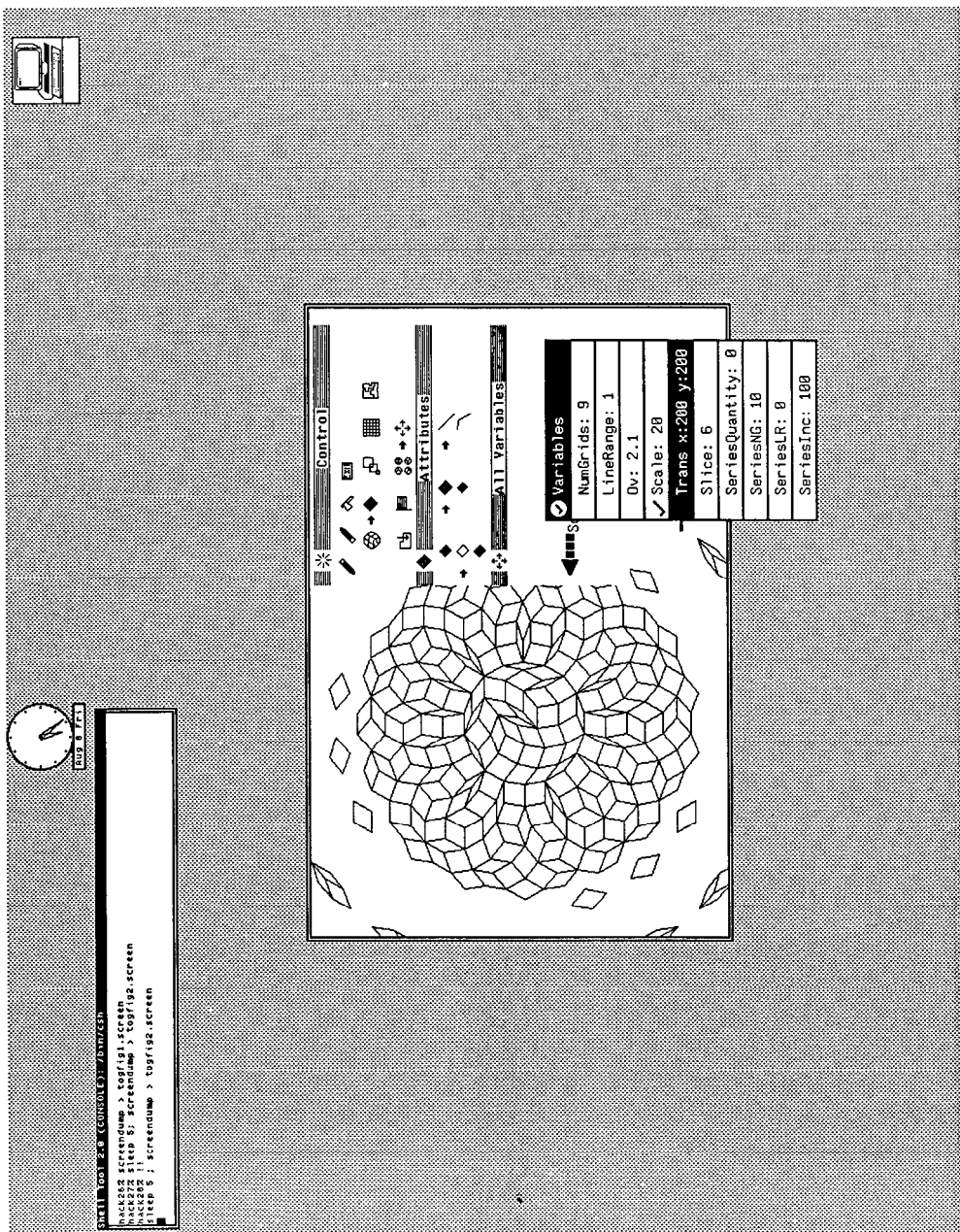


Figure 5



Variations: In addition to clicking on the arrows, the user may also simply select the value by clicking on the left mouse button and use the keyboard to type on top of the current value to change it. The increment value itself may be changed by selecting it and then typing on top of the value.

An interesting variation, suggested by a reviewer, is to press the mouse button down in the 10 box (for example) and slide the mouse, causing the value to increment/decrement in units of 10. This effectively gives the user a set of sliders each of which functions at a different resolution.

Button presses can also be treated in the same manner in which keyboard repeat keys usually work. When the button is pressed, the increment occurs, and, if the button is held down, the increments keep occurring after an initial delay.

Conclusion: The user has three effective and redundant mechanisms for changing the value: using the arrows, using the pop-up menus, and directly overtyping. A version of the incrementor has been implemented on a Sun Microsystems computer as part of a graphics system for research in design automation.

Reference:

1. Ressler S. Tiletool: A graphical interface for the exploration of generalized penrose tilings. National Bureau of Standards, Internal Report NBSIR-86-3488.