The Omino Font
by Eric Harshbarger

Abstract
At many times during my writing about, or creating puzzles with, pentomino shapes I have desired an easy way to insert such shapes into the text of a document. To that end I decided to design a custom font that would incorporate all 90° rotations and reflections of the twelve pentominoes. When finished I had actually created a font that included not only all pentominoes, but also all such shapes of order less than five (i.e. all tetrominoes, trominoes, the domino, and the monomino). How to "map" all of the designs of such shapes onto the keyboard of a computer was a non-trivial exercise. The decisions behind such a map are the topic of this document.

The Pentominoes
There are twelve basic pentominoes (shapes that are formed by the edge-to-edge conjoining of five unit squares). These shapes were first studied in detail by mathematician Solomon Golomb, and he was the first to propose a lettering scheme to name the shapes. His assignment of twelve letters of the alphabet based on the pieces' rough correspondences to the shapes of those letters are still used to this day:

f   i   l   n   p   t   u   v   w   x   y   z
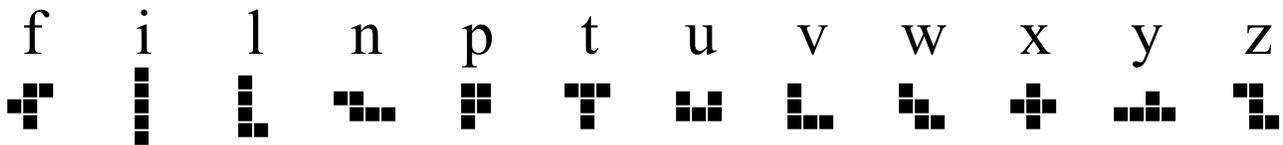
The above associations provide the basis for my Omino font.

The Font
My writings about pentominoes require that I depict not only the twelve shapes above, but also, I often need to present such icons at different orientations. For example, there are eight ways to p-pentomino could be displayed:

Depending upon a base shape's symmetries, there could be 1, 2, 4 or 8 variations for it. The main challenge in designing a useful font was deciding how to assign the various transformations to the keys of the keyboard.

The initial inclination proved not to be the best. At first I thought that I should try to correlate a piece's transformations with other letters of the alphabet according to rough iconography. For example, the 180° rotation of "p" above (third in the list), looks very much like a lowercase "d", so why not assign ▉ to "d" on the keyboard? Certainly this would be easy to remember, and creating assignments that are quickly recalled is the goal here. With so many rotations and reflections to deal with, the new font would only truly be useful if the user could, with little effort, find the correct key to type in order to get the desired transformation. If the typist was having to waste valuable time hunting and pecking in search of a particular shape, the Omino font would hardly be worth the trouble.

But while the ▉ to "d" assignment above seems quite reasonable, I quickly realized that it was not practical. Too many of the other transformed pieces were just too foreign to really justify assigning to a

particular letter of the alphabet. And, conversely, several of the letters of the alphabet simply did not lend themselves to any of the transformations. For example, to which letter should I assign the ▪▪▪▪ pentomino? Even looking beyond the letters of the alphabet to the other typographic glyphs on the keyboard, there is no great choice. And what about the the other direction? To which, if any, transformation should I assign the letter "k"? or what about the capital "G"? I was going to have to use up most of the letters (lower- and uppercase) in my font because there are a lot of transformations to account for. If the choices based on shape-identifications were not obvious, then no mneomic would be achieved.

I decided to use a different tactic. While the twelve basic letter assignments would be retained (and assigned to lowercase versions of those letters), the transformations for a particular piece would be dependent upon *the position of the keys in the vicinity of those base letters on the keyboard*. For example, with the "p" key assigned to ▐▐, I then chose nearby keys in a clockwise path to represent clockwise rotations of that original piece. Thus, the following assignments were made:

p	▐▐
o	▀▄
9	▮
0	▄▄
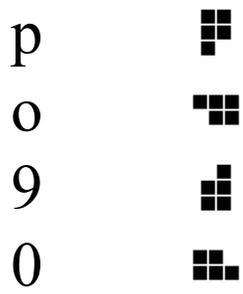
So, while there is no shape-correspondence between the "0" and ▄▄, with the base ▐▐-key known, it is easily understood (and remembered) that going to the key counterclockwise from the "p" (i.e. the "0") will yield a counterclockwise rotation of the base shape. Furthermore, I decided that typing a "shifted" version of a key would, most of the time, *vertically reflect* the "unshifted" shape. For the letter keys, this means that a capital letter is usually the vertically reflected version of the lowercase letter (e.g. with "p" corresponding to ▐▐, "P" corresponds to ▐▌). The only time this rule is altered is when the shape is invariant under vertical reflection. In the case of "i" assigned to ▮, "I" is assigned to its rotation, ▬▬▬. ▐▐ and ▐▌ are both reflected horizontally. ✦ is unchanged. Other, lower-order, polyominoes are handled in a similar manner.

There were still many decisions to make, however, since those basic twelve pentominoes do not have their letters equally spaced about the keyboard. It would have been nice to have clockwise loop-assignments always be "tilted" in roughly the same direction, or two-key pairs always drift in the same direction, but compromises had to be made to fit all of the related transformations onto adjacent keys.

After all of the mapping decisions for the pentominoes were made, I realized that there were actually enough free keys left over to map the lower order polyominoes as well. With a few more adjustments to my original keyboard map, I finalized the following assignments (the upper image is the "unshifted" keyboard while the lower image depicts results when the SHIFT-key is depressed). The blue arrows group related transformations, and the red icons indicate the base shape I used to try to assign the base key of a group. I hope that the assignments and their positions on the keyboard are intuitive enough that a user of the Omino font can quickly remember how to find any of the polyominoes he or she may need. Of course, if your keyboard has keys in different positions (I based mine upon a PC-laptop), some of the adjancencies may not hold.
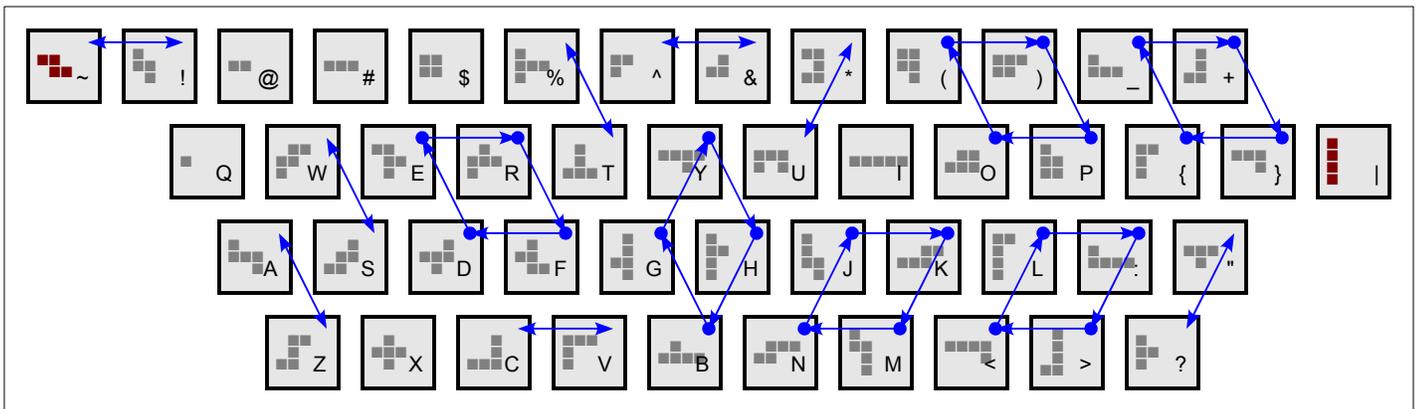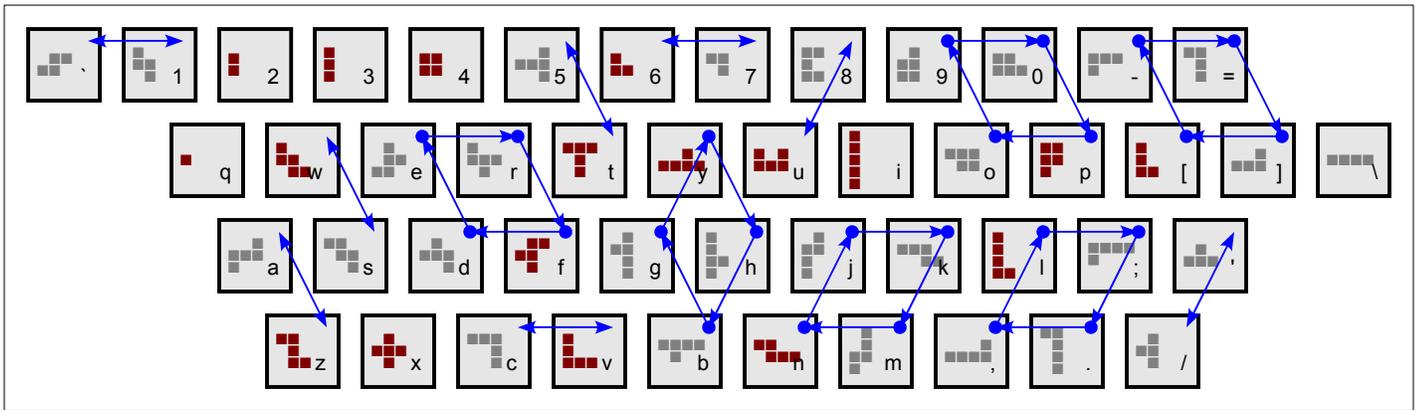
Decisions about key assignments for the base shapes besides the twelve pentominoes discussed above are justified below:

- ⬛ looks very much like a tilde, so it is assigned to that SHIFT-key. Wanting to keep the rotated version on an adjacent key forced the ⬛ assignment to the "!" key.
- ⬛ looks a bit like a square bracket, and this was the only area left on the keyboard with a four-key grouping for clockwise rotation.
- ⬛ could have been assigned to the "4" key to continue the theme started with the "2" and "3" keys, but the "1" key was going to violate that theme anyway, and the "|" certainly reminds one of the ⬛ shape.
- With ⬛ assigned as above, the ⬛ is an obvious choice for "4" now.
- ⬛ is assigned to the double quotation mark mainly just by default at this point. A second, adjacent, key (the question mark) was also available to accommodate the rotation.
- ⬛ is assigned to "3" and is easily remembered.
- ⬛ not only looks a bit like "6", but the "7" key could also be made available for the rotation. One could also argue that the ⬛ looks like "^".
- ⬛ gets assigned to "2" and is obvious.
- ⬛ is assigned to "q" by necessity at this point. It would have been nice to assign it to "1", of course, but the ⬛ discussion above addresses that topic.

The Omino font is available at my website here:

http://www.ericharshbarger.org/cgi-bin/logolog.cgi?20141029