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ControlTree: Navigating and Selecting in a Large Tree

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► **To cite this version:**

Caroline Appert, Jean-Daniel Fekete. ControlTree: Navigating and Selecting in a Large Tree. ACM symposium on User interface software and technology, 2006, Montreux, Switzerland. inria-00539065

HAL Id: inria-00539065

<https://inria.hal.science/inria-00539065>

Submitted on 23 Nov 2010

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preserving label readability. Labels in the *child zone* are horizontal and aligned vertically to provide a good readability. However, displaying every label horizontally and avoiding occlusion consumes screen real-estate. To solve this problem, ControlTree changes its labels layout as the focus node changes as shown in Figure 2. Labels in the sibling and parent zones are displayed at a 45 degrees angle to minimize potential collisions. ControlTree also takes care not to clutter the interaction area between the focus node and its children: in the child zone, labels are on the right side of the icon nodes while in the parent and sibling zones, labels are on the left.

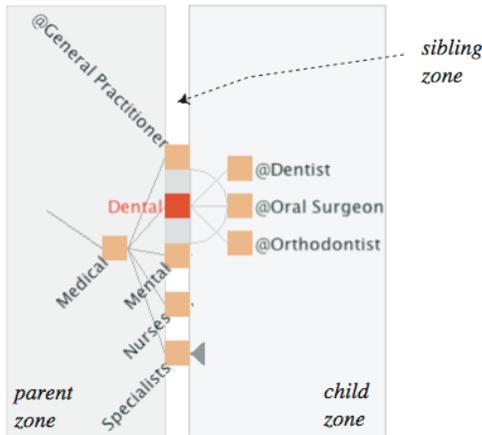


Figure 2: The three zones around the focus node (“Dental”).

ControlTree is designed to allow a precise and fast control over node transitions using a continuous gesture to optimize navigation and selection time over a large tree. When a tree is large, several problems arise:

1. the number of children of a node can be arbitrarily large, making it hard or impossible to read their labels and select them precisely;
2. at a specified level, children may end up above or below the viewport and become invisible and unreachable;
3. when navigating on a deep path, nodes may disappear to the right of the viewport.

ControlTree offers interaction and layout methods to overcome these problems.

Interaction

With ControlTree, users just have to follow the successive nodes leading to the target node. ControlTree dynamically uses the direction of the user’s trajectory and the cursor position to reach successive nodes.

Simple selections are simple. Since siblings are aligned vertically, their distances to the focus node vary. A *snapping* mechanism accelerates the selection and increases the number of levels that can be displayed by pulling the target node under the cursor before it is reached. However, this mechanism is appropriate when the chance to make a bad anticipation is acceptable, i.e. when the difficulty of selection is within a specified threshold. We now describe how ControlTree adapts its layout to keep the difficulty bounded.

Difficult selections are possible. There is no unique value of *tchild* that optimizes the efficiency for selecting each node in a given tree. With a fixed *tchild* value, the angular precision required to select a node increases with the degree of its parent.

To address this problem, we have adapted the OrthoZoom Scroller, a technique to efficiently navigate and select a target in large 1D spaces [1]. OrthoZoom Scroller uses the orthogonal direction to control zooming while panning is achieved along the collinear direction. ControlTree uses the distance from the focus node to the current point for controlling the spacing between nodes and the direction to choose the nodes that remain within the display area. Each time the mouse is moved we look for the potential target child *c* and adjust the space between nodes while taking care of preserving the position of *c*. *c* progressively repulses its siblings, making itself easier to reach (Figure 3). Thus, while interacting, the user only needs to look at the target node and follow its direction.

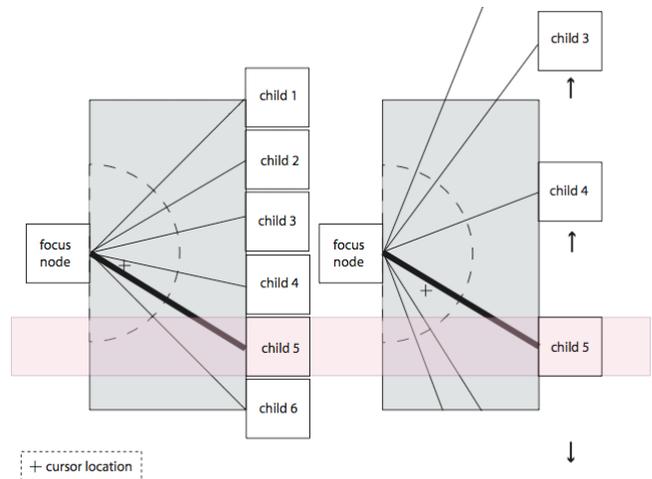


Figure 3: ControlTree strategy to ease a difficult selection.

We have designed an algorithm to dynamically adjust the distance between the focus node and its children each time the focus changes to improve ControlTree usability. This distance is a function of the number of children. Although we optimize the viewport real estate, the user can still reach the right edge of the display area. We provide a modal panning on the tree using a drag interaction. The user can also use the mouse wheel to scroll the children of the focus node while their spacing is kept constant.

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