

Notes on the History of Radial menus, Pie menus and Marking menus

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The earliest known work on radial menus dates back to 1969 [11] and is further documented in the popular textbook from 1979 on computer graphics by Newman and Sproull [12]. This work was the first working version of a radial menu system and documented the time-motion advantage of displaying items surrounding the cursor as opposed to displaying item in a linear list. Later work was performed at University of Waterloo in 1983 experimented with using pie style menus in a 3D computer graphics modeling system [3]. In 1987 researchers at University of Maryland began exploring radial menus, also exploring many design variations that they named “pie menus” because of their pie chart display style. The work of Callahan et. al. [2] was the first empirical comparison of linear menus and pie menus, which showed that, for single level menus, pie menus were about 15% faster and significantly reduced selection errors.

In terms of the use of gestures, a key observation reported in Callahan et. al. [2] was that items could be selected very quickly because selection could be performed without looking at the menu since direction of movement distinguishes an item. Further work by Hopkins [4, 5] reported that as an artifact of operating system input event buffering, a user could make the mouse movement needed to select from a hierarchic pie menu without having to wait for the system to display each menu. Hopkins believed that this resulted in faster menu selection times (especially when the display of menus is slow). Later work by Hopkins formalized this “mouse ahead” concept by explicitly suppressing the display of menus while dragging.

Kurtenbach [6] further refined the “mouse ahead” artifact by introducing the concept that cursor movement during selection generates a path that identifies a particular menu item. Furthermore, if the cursor left an ink trail when generating one of these paths, a mark that identifies a menu item is created. Given the notion of a mark

Kurtenbach then introduced the notion of *scale independence*: a mark can be draw at any size and only the shape of the mark, not its size, identifies the menu-item being selected. Kurtenbach believed that scale independence was a critical property in allowing very fast selection. In earlier pie menu systems, the user, even when selecting using “mouse ahead” still had to be aware of the size of the menus and carefully control their movement. Kurtenbach believed that with this constraint removed, menu selection could be performed even faster and this effect would even be more pronounced in hierarchic menus. Other researchers have since begun utilizing the concept of scale independence [13].

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