Towards a Functional Fitts’ Law: Modeling Touch Interactions on Very Large Touchscreens

Leslie M. Blaha
Engineering Research Psychologist
711th Human Performance Wing
Air Force Research Laboratory
Wright-Patterson Air Force Base, Ohio

Touchscreens are quickly becoming pervasive platforms for human-computer interaction, and large dimension touchscreens (over 50 inches in diagonal) pose interesting ergonomic challenges to human users. Touch interaction requires users to position themselves close enough to the screen that they are able to interact with the entire surface, which results in screen elements outside the immediate field of view. Ergonomic challenges arise from the exaggerated body and limb movements required for direct touch interaction, which is more physically demanding than typical mouse, stylus, or keyboard interactions. The present effort characterized touch-based interactions on a very large, 82-inch diagonal touchscreen display, using standard input device testing methods based on Fitts’ and Steering Laws. These laws model movement time against an index of difficulty manipulation, which is a function of the distance between targets and width of the targets or paths. Movement time was measured in a series of tasks including tapping, constrained straight and curved path tracing, and unconstrained and constrained object dragging.

We confirmed through regression analysis of the movement times against the index of difficulty that movements on very large touch screens conformed to Fitts’ and Steering Laws. Further, within each task, cumulative hazard functions were ordered by the index of difficulty, confirming the efficacy of the difficulty manipulations. Hazard analysis provides a novel, functional measure of information throughput in this domain. Juxtaposition of these two analyses provides additional insights into the notion of “efficiency” for human-computer touchscreen interactions. And because touchscreens capture the full end-point dynamics of the touch interactions, we expand our analyses to functional level utilizing Gaussian process regression. We illustrate an exciting potential for dynamic applications of this combination of analyses on eye and hand movements in a touch screen-based task.