Fitts' Law

The time required to move to a target is a function of the target size and distance to the target.

According to Fitts' Law, the smaller and more distant a target, the longer it will take to move to a resting position over the target. In addition, the faster the required movement and the smaller the target, the greater the error rate due to a speed-accuracy tradeoff. Fitts' Law has implications for the design of controls, control layouts, and any device that facilitates movement to a target.[1]

Fitts' Law is applicable only for rapid, pointing movements, not for more continuous movements, such as writing or drawing. It has been used to predict efficiency of movement for assembly work performed under a microscope, as well as movement of a foot to a car pedal. Pointing movements typically consist of one large, quick movement toward a target (*ballistic movement*), followed by fine-adjustment movements (*homing movements*) to a resting position over (*acquiring*) the target. Homing movements are generally responsible for most of the movement time and cause most errors.[2]

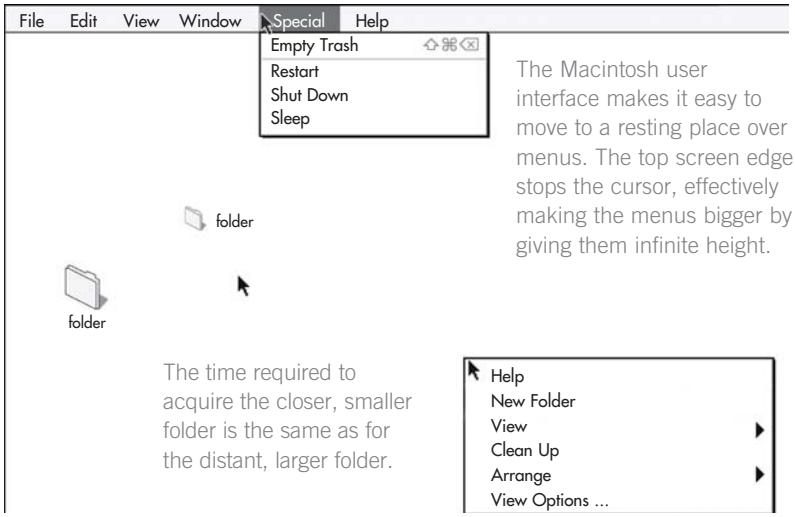
Designers can decrease errors and improve usability by understanding the implications of Fitts' Law. For example, when pointing to an object on a computer screen, movement in the vertical or horizontal dimensions can be constrained, which dramatically increases the speed with which objects can be accurately acquired. This kind of constraint is commonly applied to controls such as scroll bars, but less commonly to the edges of the screen, which also act as a barrier to cursor movement; positioning a button along a screen edge or in a screen corner significantly reduces the homing movements required, resulting in fewer errors and faster acquisitions.

Consider Fitts' Law when designing systems that involve pointing. Make sure that controls are near or large, particularly when rapid movements are required and accuracy is important. Likewise, make controls more distant and smaller when they should not be frequently used, or when they will cause problems if accidentally activated. Consider strategies that constrain movements when possible to improve performance and reduce error.

See also Constraint, Errors, and Hick's Law.

[1] The seminal work on Fitts' Law is "The Information Capacity of the Human Motor System in Controlling Amplitude of Movement" by Paul M. Fitts, *Journal of Experimental Psychology*, 1954, vol. 4, p. 381–191. The Fitts' law equation is $MT = a + b \log_2 (d/s + 1)$, where MT = movement time to a target; $a = 0.230$ sec; $b = 0.166$ sec; d = distance between pointing device and target; and s = size of the target. For example, assume the distance between the center of a screen and an icon of 1" (3 cm) diameter is 6" (15 cm). The time to acquire the icon would be $MT = 0.230$ sec + 0.166 sec ($\log^2 (6/1 + 1)$) = 0.7 sec.

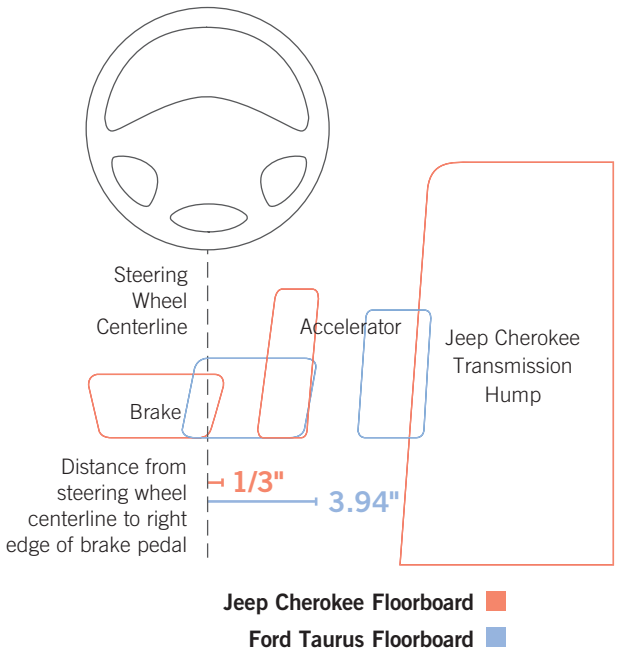
[2] See "Human Performance Times in Microscope Work" by Gary Langolf and Walton M. Hancock, *AIIE Transactions*, 1975, vol. 7(2), p. 110–117; and "Application of Fitts' Law to Foot-Pedal Design" by Colin G. Drury, *Human Factors*, 1975, vol. 17(4), p. 368–373.



The Macintosh user interface makes it easy to move to a resting place over menus. The top screen edge stops the cursor, effectively making the menus bigger by giving them infinite height.

The time required to acquire the closer, smaller folder is the same as for the distant, larger folder.

The Microsoft Windows user interface presents pop-up menus when you press the right mouse button. Since the distance between the cursor position and the pop-up menu is minimal, menu items are quickly acquired.



In the 1990s, many cases of unintended acceleration were reported in Chrysler Jeep Cherokees. Brake pedals are usually located to the right of the steering wheel centerline, as in the Ford Taurus. However, the Jeep Cherokee's large transmission hump forced the pedal positions to the left. This increased the distance between foot and brake pedal, making the latter more difficult to reach. This, combined with a violation of convention, caused Jeep Cherokee drivers to press the accelerator when they intended to press the brake pedal.