**Fitts’s Law**  
*P. Fitts, 1954*

- First applied to HCl by Card, English, and Burr, 1978
- Later adapted for asymmetric targets by MacKenzie and Buxton, CHI 1992, who got better results than using $W$ with two models
  - SMALLER-OF model: $W$ is replaced by $\min(W, H)$
  - $W'$ model: $W$ is replaced by $W' = \text{extent of target along approach vector}$

But see also Accot and Zhai, CHI 2003  
It’s complicated! Especially when $H, W$ differ greatly!
Fitts’s Law P. Fitts, 1954

- Applied to menus in Windows vs. macOS
  - macOS menu bar is at top of screen
    - Acts as if it has infinite $H$ or $W' \rightarrow$ Faster to target!

- Applied to corners in macOS
  - “Hot corners” in Mission Control
    - Act as if they have infinite $H$, $W$, or $W' \rightarrow$ Faster to target!
Fitts’s Law  P. Fitts, 1954

- Note complications when Fitts’s Law is to be applied over a large range of
  - Distance to target
  - Angle to target
  - Size of target
  - Aspect ratio of target
  - Shape of target

Steering Law  J. Accot and S. Zhai, CHI 97 (generalizing earlier work)

- How quickly can the user steer through a 2D tunnel (free-hand tracing, sketching, constrained motion)?
- Harder than a Fitts’s Law task, since the cursor must remain in the tunnel!

MT = a + b (A / W)
- For a straight tunnel of fixed width, where
  - A is path length
  - W is path width
  - a and b are constants
- Can be generalized for more complex tunnels (varying width, trajectory)
Steering Law J. Accot and S. Zhai, CHI 97
(generalizing earlier work)

- Modeling interacting with a hierarchical walking menu
  - Sum of vertical and horizontal steering tasks

\[ MT_n = a + b \left( \frac{nh}{w} \right) + a + b \left( \frac{w}{h} \right), \text{ where} \]
- \( n \) is number of submenu (\( n^{th} \) submenu)
- \( w \) is width of (sub)menu
- \( h \) is height of (sub)menu item

\[ MT_n = 2a + b \left( \frac{nh}{w} + \frac{w}{h} \right) \]

Note: This is an approximation, assuming same coefficients \( a, b \) for horiz/vert

A Composite Interaction Task for Locator Devices: Snap Dragging
E. Bier and M. Stone, SIGGRAPH 86

- Extends basic idea of grids
- Automatic generation of alignment objects
  - Gravity-active points, lines, circles
- Generation based on
  - User hints
  - Heuristics about editing behavior

http://www.youtube.com/watch?v=7L8RT3M8Yeo
**Heuristically Generated Alignment Lines in PowerPoint 2010–2016**

- Dragging object (circle) creates an alignment line when its bounding box edge/center lines up with the bounding box edge/center of another object (rectangle)
- Also, smart guides (Adobe Illustrator), dynamic guides/alignment guide (CorelDRAW),…

**Grid (aka Design Grid)**

- A system of intersecting lines used to constrain position and size of content
  - Typically vertical and horizontal
  - Often arranged in repeating modules

Two classic books on grids for graphic design
Grid (aka Design Grid)

- Bootstrap uses rows of 12 equal columns
- Columns can be combined in a row to create < 12 columns of varying width
- Columns are separated by gutters
- Responsive = Layout can change in response to device width

http://getbootstrap.com/docs/4.0/layout/grid/